

33rd
YEAR

CHEMICAL WEEKLY

VOL. XXXIII

MAY 24, 1988

NO. 37

HISTORY

CREATING

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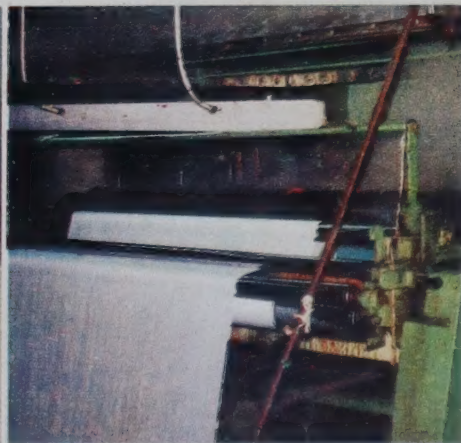
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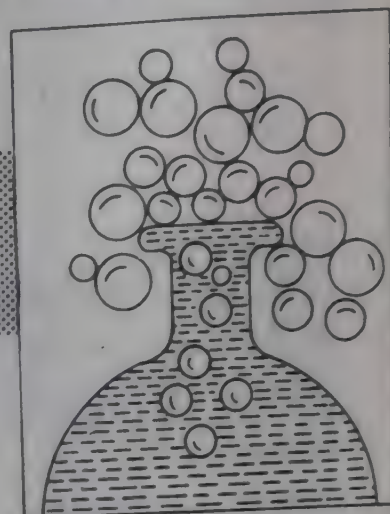
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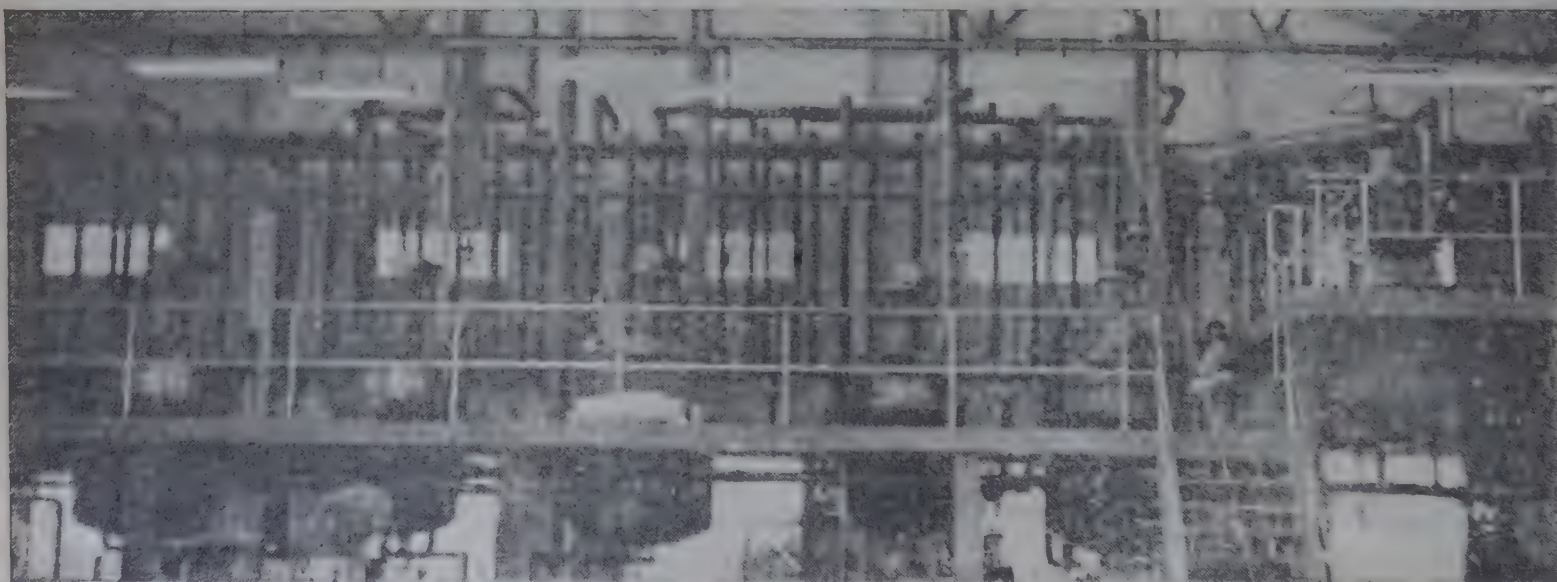
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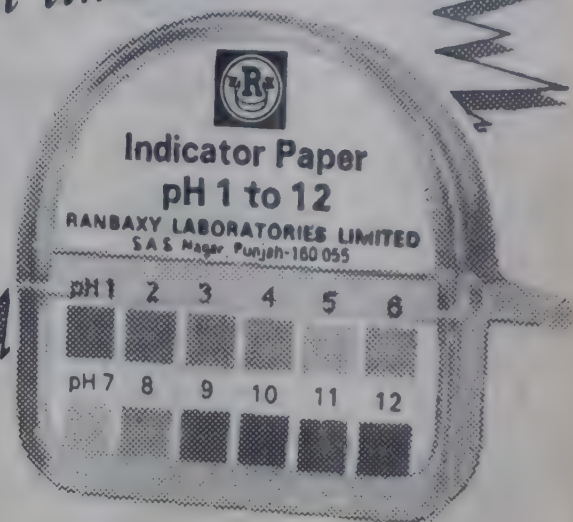
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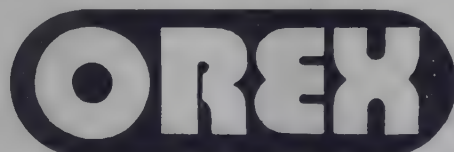
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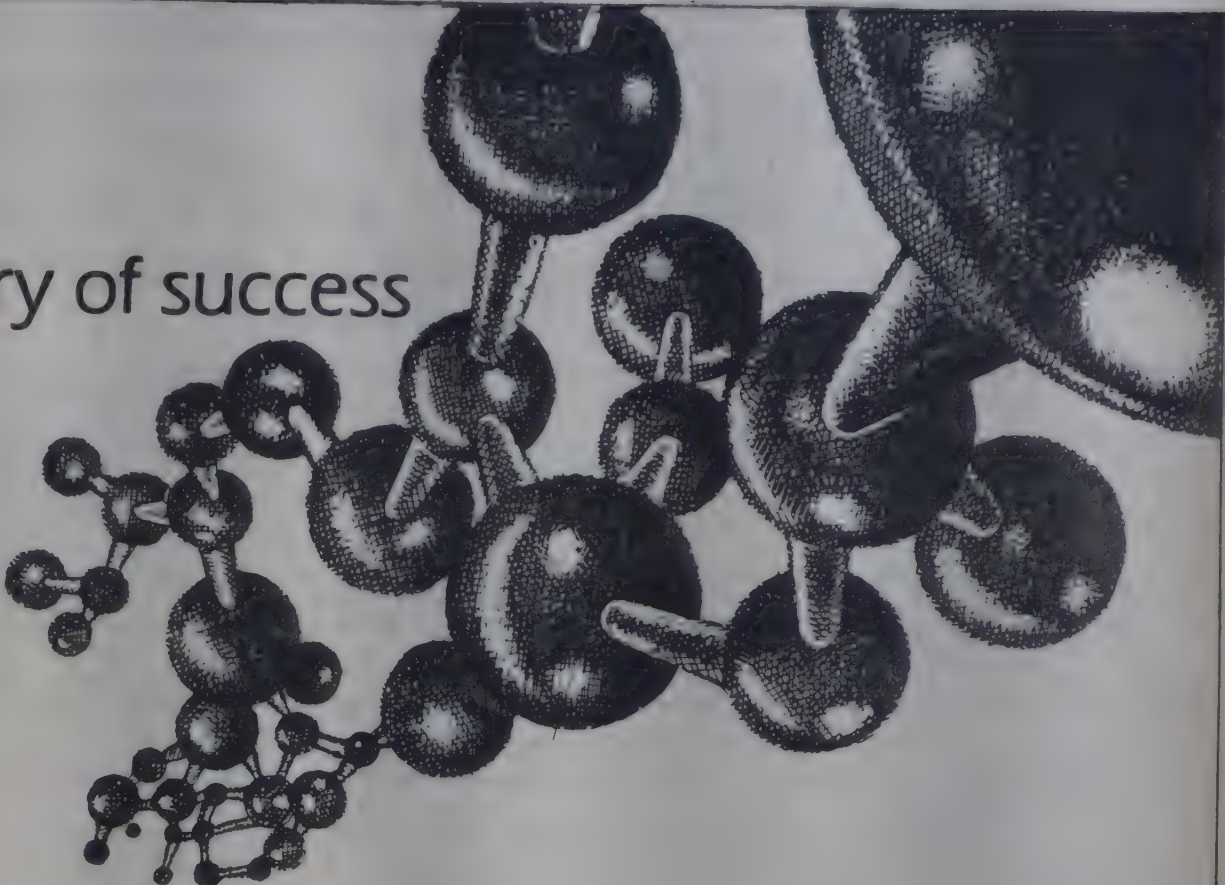
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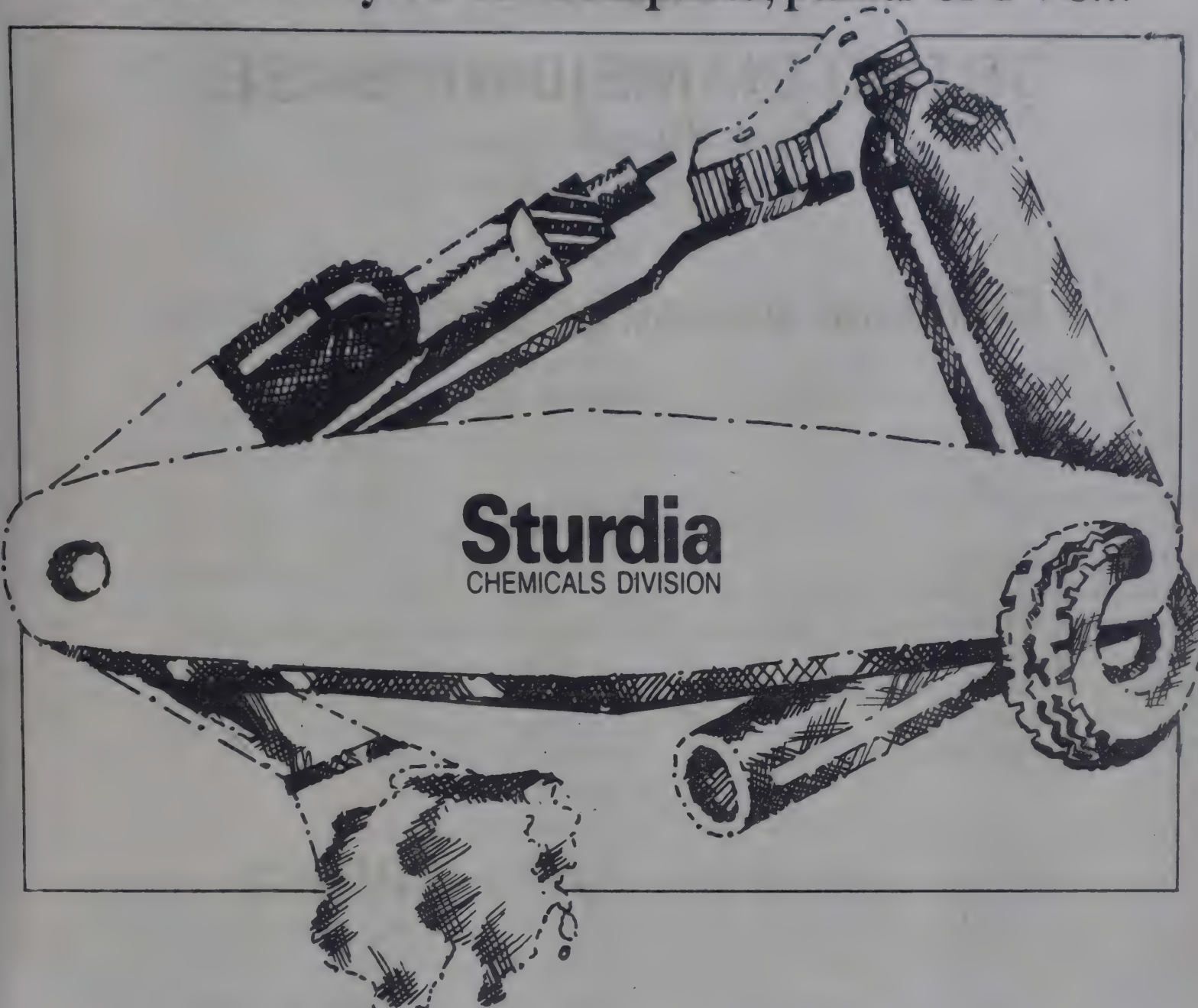
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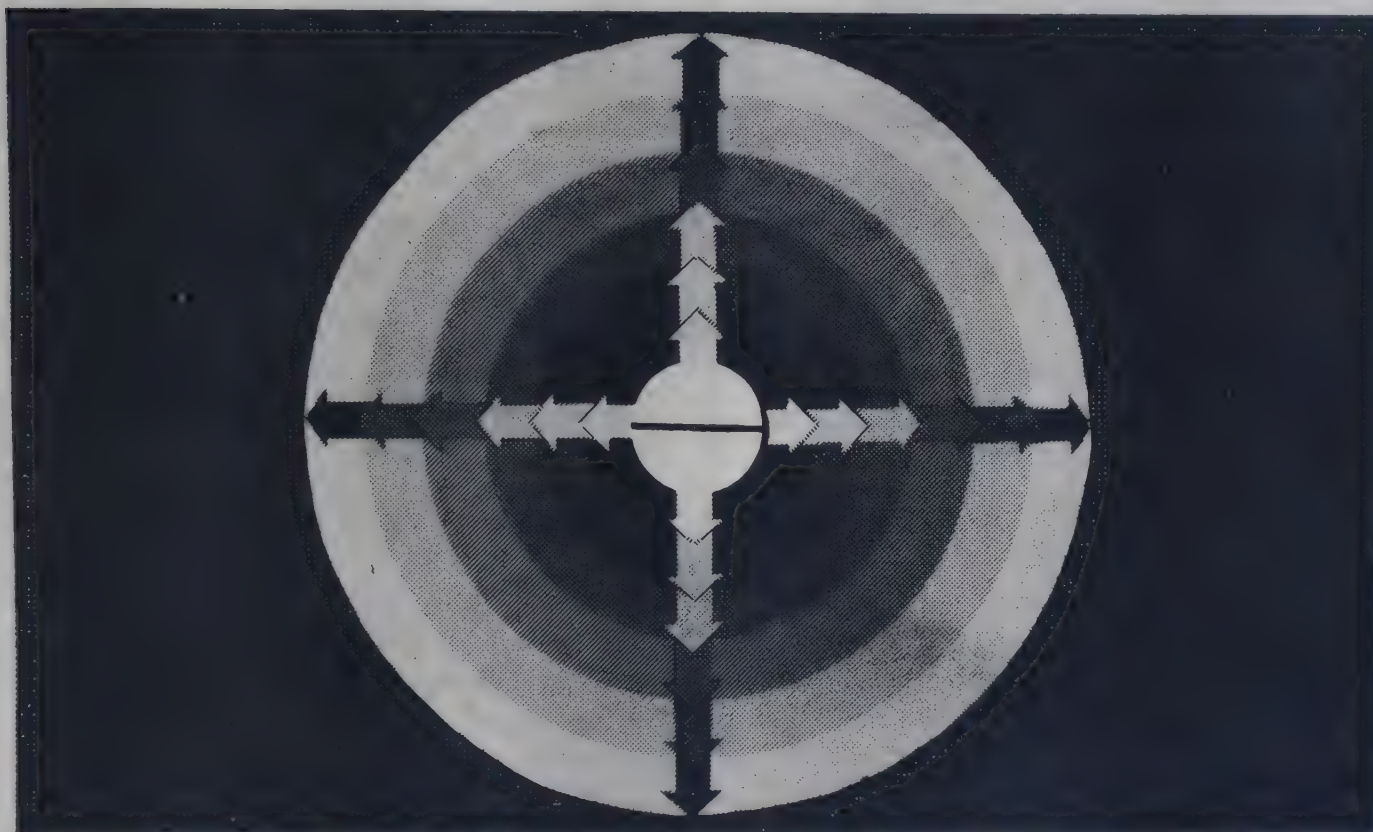
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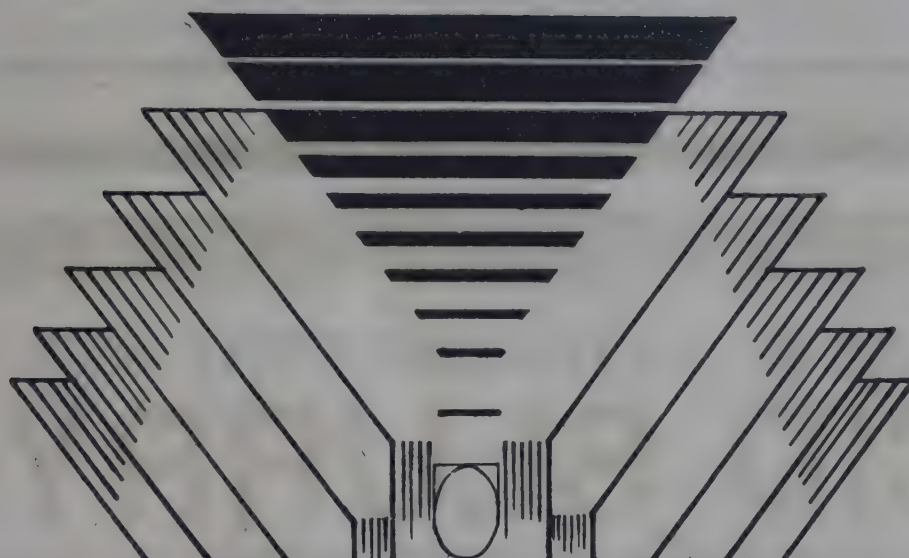
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CHEMICAL WEEKLY

VOL. XXXIII

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NO. 37

NMR -- The New Diagnostic Technique

NMR, Nuclear Magnetic Resonance imaging is being heralded by the world medical community as the greatest diagnostic advance since Wilhelm Rontgen discovered the penetrating powers of the X-rays in 1895. The superiority of NMR over other diagnostic imaging techniques is readily conceded by the medical fraternity. While the X-rays give only anatomical information about tissues, NMR tells something about their chemical constitution as well.

NMR imaging is based on magnetic principles. Patients are placed in a hollow magnet for NMR scanning. This magnet causes the nuclei of hydrogen atoms (the N in NMR) to line up parallel to the magnetic field and resonate (the R). A radio frequency pulse is sent into the patients body, causing the resonating nuclei to change alignment. In this new alignment, the nuclei themselves begin generating a voltage in a copper coil surrounding the patient. This voltage is recorded by a computer. When the radio-frequency pulse subsides, the nuclei revert to the previous alignment and stop generating a voltage. As the process is repeated, the computer converts the information it has received into two dimensional images.

The principles underlying NMR imaging are entirely different from those of X-rays which expose patients to ionising radiation whereas NMR does not. X-rays show up as shadows — dark - light and somewhere in between — reflecting how much ionising radiation the target has absorbed. The amount varies according to the density of the tissue. On the other hand NMR is tuned to Hydrogen, a major constituent of water, which the body contains in abundance. This enables NMR to provide information not only about the density of the tissue but to a limited extent about its chemical composition as well.

The name of this new diagnostic tool is not very popular. Radiologists tend to call it magnetic resonance. The publicly stated reason is that the dropping of the term 'nuclear' frees it from distasteful associations with Hiroshima and the Three mile island.

NMR is proliferating almost as rapidly as did X-rays Computed Tomography (CT or CAT Scan) machines a decade ago. In 1986, there were only 650 NMR machines in the U.S.A.

In 1987, ten manufacturers had obtained clearance from the Food and Drug Administration to market these units at a staggering price tag of \$1.5 to \$2 million.

NMR is not without its critics, Dr. William Stasson of the Harvard School of Public Health states categorically that NMR is better than CAT scan for producing images of the back of the brain, the brain stem, and the upper spine. But he is of the view that it may not provide more information than CT for producing in many other areas of the body and states that the extra information it may yield may not be of much medical value to the physicians.

Another somewhat sober view is that the NMR is a slight improvement over the CAT scan in some instances and a significant improvement in a few others. CAT was a major breakthrough in technology since it offered a new dimension of diagnostic capability — NMR also represents a breakthrough technology in the sense it is based on a whole different set of physical principles.

NMR Spectroscopy, a sister technology to NMR imaging, may well provide more detailed biochemical profiles of the living tissue. NMR Spectroscopy is still only a research tool and requires more powerful magnets than NMR imaging. However, it is registering rapid progress and may be ready for general medical use in the next five to eight years.

NMR enthusiasts predict a bright future from this kind of spectroscopy. Leading Oncologists believe that this may help chemotherapy of cancer to become more effective. Anti-tumour drugs are currently given at dosages or intervals based on the average patients biochemistry. Since these drugs are toxic, patients may die due to the drug, even before they succumb to the disease itself or the patients may be under treated, a mistake which can prove fatal. It is under these conditions that it is believed that NMR Spectroscopy can play a crucial role by helping the physician to steer clear of both pitfalls and adjust the therapy suited to the patients biochemistry. Other experts believe that such a procedure will be possible not only with cancer but with other chronic diseases as well.

Currently NMR imaging dominates the field in the U.S. It is considered to be exceptionally safe since it does not expose the patient

to ionising radiation but it has another significant advantage. NMR Scans can be done without injecting dyes or contrast materials into the patients blood stream, a practice which is essential in most kinds of X-ray studies to make tissues show up on film. About one patient out of 40,000 has a reaction to the contrast materials. Most reactions are minor, though unpleasant — nausea, vomiting, headache — but others can be more serious or even lethal. About 250 deaths are reported in the U.S. every year arising from contrast materials.

To be sure, contrast materials for NMR have been developed which "make its already superb images much better". Food and Drug Administration approval for the first contrast material — gadolinium DPTA — is expected early this year. NMR contrast material — when needed — are so chemically different from those used with X-rays and are given in such small doses that no problems are expected.

Nevertheless there are some patients for whom NMR could be hazardous. They include people wearing heart pacemakers — there is concern that the radio frequency pulses could disrupt their function — and those who have sharpnel or surgical clips containing ferrous metal in their bodies. Those with life support systems with steel parts are at risk as well. Experts recommend NMR exams for pregnant women only as a last resort because of possible injury to the foetus. Since the scans generate heat, special care is needed.

Some patients are too obese to fit into the magnet, while others are unable to be still for the 45 minutes to an hour or more needed for a scan. So cramped are the confines of the magnet and so noisy are the many models that even a few minutes may seem like an eternity and give rise to claustrophobia. Sedatives can counter restlessness and anxiety but they are not without risks especially for some critically ill patients.

Differences of opinion persist about the real significance of NMR. Old timers in the profession maintain that "the more imaging technologies that become available, the more important it is that the comparative efficacy of each be adequately evaluated and defined". But there are others who feel that this stand is obscurantist and they assert that any such appraisal of NMR imaging would be out of date by the time the study is completed, because of the rapid improvements being evolved. The general consensus is that this "innovative technique is an extra-ordinary addition to the existing diagnostic armamentarium".

At present NMR imaging is undertaken only for some applications tested well enough for routine use. The best known use is for detecting tumours in the posterior fossa, a region at the back of the brain below the ears. Largely because NMR can ferret out growths there that would otherwise be obscured by bone. Thus NMR is being regarded as the diagnostic method of choice.

Similarly, NMR is regarded as the most sensitive imaging tech-

nique for the diagnosis for multiple sclerosis but with certain reservations. The brains of patients with multiple sclerosis generally have characteristic bright spots but this may be indicative of AIDS as well; in the case of patients over 85, this may be a normal consequence of ageing. Then as in all other cases, this can be applied only when the patients medical history is studied.

New applications of NMR are often studied in very sick patients whose diagnosis are fully known.

There is today a firm belief in medical circles that in the long run NMR will replace many diagnostic techniques now employed in radiology.

It cannot be denied that this technique is staggeringly expensive. With an initial staggering cost of \$1.5 million its useful life is only five to six years. If stronger magnets are to be used, the cost may rise to \$2 million. NMR imaging units require special shielding, without which the unit may wipe out the recording of any nearby computer tapes. Electric bills for a single unit may come to \$18,000 a month. As the unit itself is huge, it can accommodate fewer patients on a working day.

Currently while CAT Scanning costs around \$150 to \$200 each, NMR costs are \$500 to \$1000. Radiologists and specialists need considerable training to learn to use NMR imaging. They often require the services of a health physicist or an electrical engineer. The training of specialists to learn and interpret NMR imaging may take three to four months. Apparent similarities between NMR generated images and those produced by older methods may be deceptive, so time is needed to learn to interpret them.

Getting the hang of NMR scanning almost invariably means comparing it with other techniques on the same patient. This again puts up the cost.

Despite its costs and the debates about its usefulness, NMR seems destined to become entrenched on the medical scene. Insurance coverage for NMR is now available.

As the NMR imaging units proliferate, there is a genuine feeling that this will join other costly technologies in underscoring the gap between those who have health insurance and the other 37 million Americans who do not.

Many radiologists feel that NMR may end up being overprescribed for those who can afford it and underprescribed or unavailable for others really needy but cannot afford it. It is upto the medical profession to ensure that such an unfortunate situation does not develop.

-- T.P.S. RAJAI

(Condensed from "NMR — The Best Thing Since X-ray") by Judith Randall
Technology Review — January, 1988.

CHEMARENA

S.L. VENKITESWARAN

Progress in Synthetic Fibres

It is reported that for the first time more than half of global production of man-made fibres including pure synthetics is in the countries other than US, Japan and West Europe together. US accounts for 21%, W. Europe 18% and Japan 10% of man-made fibres and 23%, 18% and 9% respectively of pure synthetics. India is yet to make a dent in the rest of the world category but may become significant by 2000AD. The increase in the rest of the countries has been from 30% to 50% in the case of pure synthetics. The 1987 production was 7% higher at 40 bill. pounds. The cellulosics have fallen to 7 bill. pounds

in US due to shut down of triacetate and a cutback in rayons. 60% of all cellulosics is now in other countries. The data (as per Enka) is reproduced in Table below:

TYPEWISE ESTIMATED PRODUCTION

	(Billion of lbs.)			
	1984	1985	1986	1987
Polyesters	13.0	13.5	14.5	16.5
Polyamides	8.0	8.0	7.5	8.0
Acrylics	6.0	6.0	6.0	6.0
Others	1.5	1.5	1.6	1.8

MAN-MADE FIBRES OUTPUT

	1987	1986	1985	1984
U.S.	8.51 (6.2%)	8.01 (3.4%)	7.75 (-2.1%)	7.92 (-1.5%)
Western Europe	7.11 (-0.1)	7.12 (-1.7)	7.24 (2.3)	7.08 (5.2)
Japan	3.78 (1.3)	3.83 (-3.8)	3.98 (0)	3.98 (2.6)
Other	20.49 (11.7)	18.35 (8.8)	16.87 (8.3)	15.57 (12.3)
Total	39.89 (6.9%)	37.31 (4.1%)	35.84 (3.7%)	34.55 (6.2%)

GROWTH OF SYNTHETIC FIBRES

U.S.	7.51 (7.3%)	7.00 (2.8%)	6.81 (-1.3%)	6.90 (-1.4%)
Western Europe	5.82 (0.3)	5.80 (-0.9)	5.85 (5.6)	5.54 (6.5)
Japan	3.02 (0.7)	3.04 (-2.9)	3.13 (2.3)	3.06 (3.7)
Other	16.30 (13.2)	14.40 (11.0)	12.97 (10.3)	11.76 (15.1)
Total	32.65 (8.0%)	30.24 (5.1%)	28.76 (5.5%)	27.26 (7.4%)

Source: Enka

New Molecular Sieves

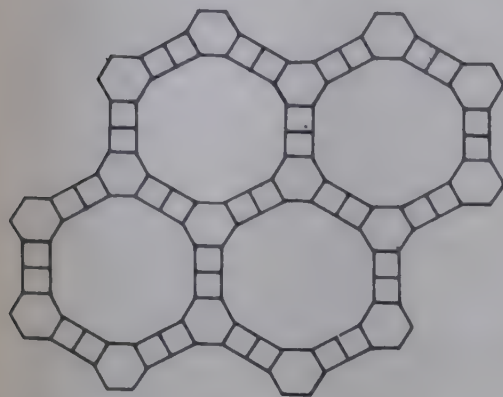
'Aluminophosphate-based "sieves" with very large pores show potential for use as cracking catalysts in petroleum refining' says a report in *CE News* of 20th March 1988. These molecular sieves have been developed by Dow Chemical in association with Virginia Polytechnic Institute.

Aluminosilicates are the widely used controlled pore zeolites or molecular sieves and Mobil's ZSM-5 is an outstanding material which converts methanol to hydrocarbons. The new breed of alumino phosphates or "alphos" have the cage and channel structure similar to

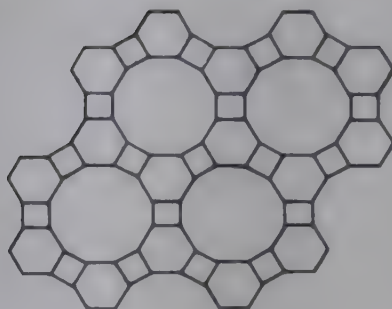
zeolites but different pore dimensions. They are composed of tetrahedrally coordinated atoms (T-atoms) with silicon, aluminium phosphono and other atoms connected to adjacent atoms by atomic bridges. The new molecular sieves termed VPI-5 have 18-membered rings of T-atoms in the same 3D topology and pore sizes of 10 Angstroms. The VPI materials are made from reactive alumino phosphate gel which contains a structure directing agent. The Aluminium-phosphorous ratio is about 1 and withstand heating upto 800°C without phase change. The structure or topology of VPI-5 and the regular $\text{AlPO}_4\text{-5}$ is shown in figure.

VPI-5 has large pores

VPI-5



AIPO₄-5



Topology of new VPI-5 molecular sieve resembles that of better known AIPO₄-5, but VPI-5 has larger rings, with pore diameters greater than 10 Å

A large number of VPI-5 have been made with a variety of added atoms -- adatoms including silicon and cobalt. The total pore volume is very large. As an example triisopropyl benzene readily absorbs on VPI-5. The kinetic diameter of triisopropyl benzene is 8.5 Å. How the large pore size and absorptive capacity can be used for catalytic reactions is yet to be worked out. Purification of large molecules and separation may be one line of applications and the potential is large.

Absorption Heat Pumping

AHP or Absorption Heat Pumping as an absorption refrigeration system can serve as a means of recovery and recycle of low temperature heat for distillation systems -- particularly fractionation. This reduces about half of the heat required by reuse of low level latent heat from tower overhead. This is said to be a better alternative to Mechanical Vapour Compressor (MVC) which needs high electrical power. In the case of MVC only pumps are required and the product is unaffected as it uses an independent fluid for vapour heat recovery. Unlike the Rankine cycle system of using a low boiling liquid here absorption heat of solution is used. An analysis of such a system in use for C₄ separation which is in commercial operation is given in *HP*, Dec. 1987. The base system of C₄ separation (n-butane and isobutane) and the AHP system of recovery for heat (and recycle to the reboilers) are in figures 1 and 2.

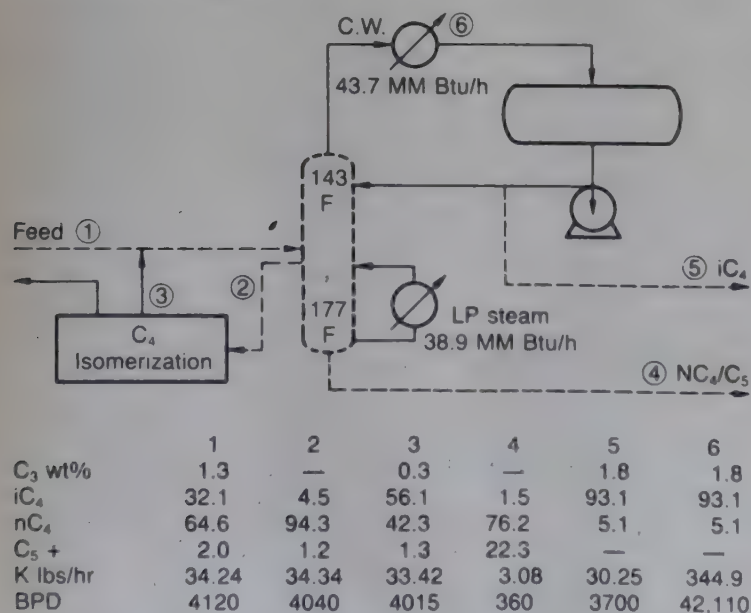


Fig. 1: Heat pump study basis

The system uses a lithium bromide solution as the means or working fluid presumably because of the high heat of absorption in spite of high cost and perhaps tendency to corrosion of equipment. As per flow sheet the absorption solution circulates between the higher and low pressure steam, heat exchangers -- in this case 11

	Incremental capital cost (MM \$) Base	Savings in operating cost (\$/year) Base	Payback (year)
Conventional MVC			
Steam driven	2.369	290,500	8.1
Motor driven	1.808	614,200	2.9
AHP	0.652	605,900	1.1

In case of retrofits, the above capital costs increase to \$2.907 MM, \$2.346 MM and \$1.088 MM; payouts are 10.0, 3.8, and 1.8 years

psia and 2 psia. The steam generated in the condenser G is at 195°F and supplies heat to the reboiler -- a strong Li Br solution which liberates heat as 2 psia steam at 195°F. Part of the reboiler heat is from another heat exchanger using LP steam. The working fluid is transported from low pressure absorber to the high pressure generator by the circulating absorbent.

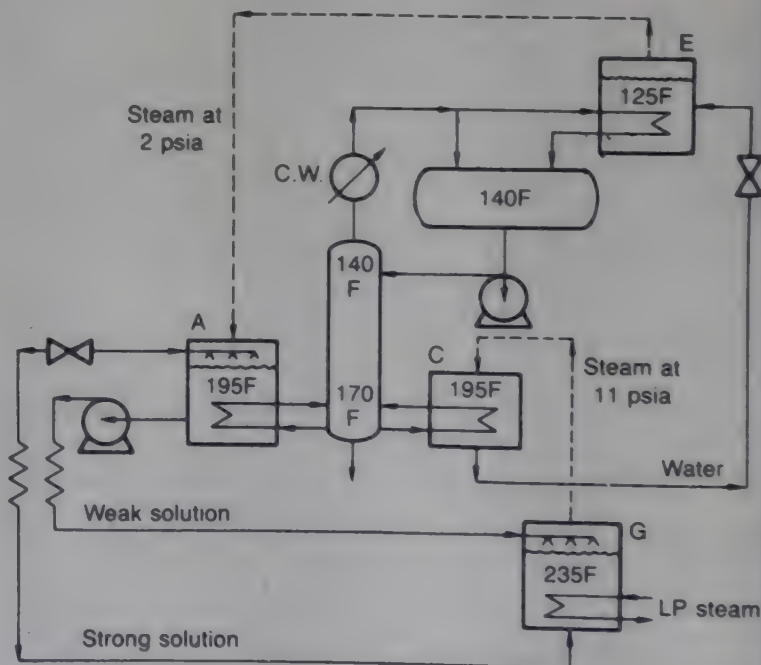


Fig. 2: Absorption heat pump

AHP can be operated at higher temperatures for other systems up to a maximum of 330°F for the driving end (forward, steam 130 psig) and 302°F for the reverse (50 psig). It would be useful to work out such a system for heat recovery and reduction of energy for other systems such as ethanol distillation in India.

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New pesticides subsidy scheme soon

The Government will soon put through a scheme of providing subsidy on sale of certain pesticides to the farmers.

This follows an official assessment that the benefits of cuts in duties on pesticides may not reach the farmer despite a reduction in prices by manufacturers. The Agriculture Ministry feels that under the existing delivery system for inputs, the middlemen may pocket the cuts.

The pesticide manufacturers have also mounted pressure on the Government against allowing import of pesticides under Open General Licence (OGL) alleging dumping by foreign suppliers, particularly the Taiwanese. Imports of pesticides under OGL were allowed by the Government following the report of the task force of the Planning Commission that some of the domestic manufacturers were charging more than the fair price for their pesticides.

The Planning Commission and the Agriculture Ministry want to keep the threat of imports open so that the domestic manufacturer, some of whom have formed cartels, are forced to keep the prices down. However, the industry Ministry appears to favour taking the pesticides imports off the OGL list so that the domestic manufacturers are protected.

It may be recalled that the Planning Commission task force had considered a proposal to operate a Rs. 24-crore subsidy scheme for pesticide use as a part of the agricultural production package.

However, the task force itself had said that an alternative to the subsidy, more convenient to the farmer would be to reduce the cost of pesticides through a pricing strategy. Such a strategy would obviate the need for the farmer to go through the formalities of subsidies.

The framework for such pricing strategy is also already available in the report of Bureau of Industrial Costs and Prices (BICP) which had made a study of seven pesticides. These were Monochrotophos, Methylparathion,

Dimethoate, Dithanem-75, BHC, Malathion and Endosulfan.

BICP had estimated that of the seven, the selling price of the technical grade of three pesticides is close to the estimated fair price. Keeping this small difference at zero, the average extent to which the selling price is higher than the estimated fair price of seven pesticides is 10.69 per cent. BICP had suggested that given the complexity in the formulation and marketing of pesticides, price control may not help the farmer but that the

same objective could be attained an appropriate strategy of selective imports and regulated tariff policies discipline domestic prices.

Though BICP report was prepared a few years ago the task force recommended this policy since the price of pesticides had more than kept up with the general price rise since BICP submitted its report.

Based on the recommendations of the task force, the Government announced steep cuts in customs duties as well as excise concessions. Similarly, import of 15 pesticides was allowed under OGL.

Drug activists set up generic unit

Drawing inspiration from the Hathi Committee report and the World Health Organisation recommendations, a group of drug activists have come together to set up a firm to manufacture and market generic drugs.

The Rs. 28-lakh Ratnagiri Drugs Pvt. Ltd. (RDPL), set up in MIDC estate in the backward Konkan region, will be the first company in India to market generic drugs in prescribable form, according to Dr. Wishwas Rane, Marketing Director.

At present, single ingredient formulations carry the generic name of the drug, along with the brand name. However, most companies promote the drugs by the brand name and most doctors use the brand name in their prescriptions.

In the long run, RDPL hopes to manufacture all the 200 drugs mentioned in WHO's Essential Drug List and the 30 complimentary drugs for use in exceptional circumstances and rare disorders. In 1975, the Hathi Committee appointed by the Government concluded that 116 drugs are sufficient for the country's basic health needs and that these should be made available under their generic names. This was, however, not implemented.

To begin with the company proposes to manufacture 10 essential drugs, including aspirin, paracetamol, metronidazole, propranolol and mebendazole, Dr. V. P. Valame, Managing Director, said. The factory, complete with a testing lab, is awaiting FDA approval to begin production. He hopes to

achieve a Rs. 60-lakh turnover in first year.

Dr. Rane said there are some 60,000 formulations in the Indian market contrast to 6,500 in the UK. The WHO list of 200-odd drugs is sufficient to treat 80 per cent of the diseases. The rest are either ineffective or harmful, he said.

He cited the example of streptomycin which reportedly killed the AIC Secretary, Mr. Vasudev Panicker. The All-India Drug Action Network has been campaigning to ban this "irrational combination" for the last eight years.

Dr. Zafrullah Choudhary, the main architect of Bangladesh's new essential drugs policy, is to inaugurate RDPL on May 24. Dr. Choudhary was instrumental in shaping his country's drug policy which is built mostly on the basis of recommendations of the Hathi Committee and WHO. Dr. Choudhary has also been a source of inspiration to a number of Indian drug activists and consumer groups.

According to Dr. Rane, about 70 per cent of the doctors prefer generics but cannot prescribe as the same is not available in prescribable packs. Some essential drugs are available today in generic form but only in dispensing packs. RDPL's products will be cheaper than branded drugs by at least 25 per cent. Prices could have been much cheaper but for the fact that the company has to fight well-entrenched brands and sell the new concept to doctors, Dr. Rane said.

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Hopeful signs on Haldia project

The recent meeting of members of Parliament from West Bengal with industry minister Vengal Rao has once again raised hopes of a clearance for the much-delayed Haldia Petrochemicals project.

Mr. Vengal Rao assured the West Bengal MPs, who were visibly concerned over the delay in implementation of the Haldia project, that he would soon write to the finance minister requesting him to meet the chief minister of West Bengal to sort out pending issues. As far his ministry was concerned, all clearance had already been given he pointed out. Apparently there was some problem at the finance ministry level which needed to be resolved.

All concerned are now looking forward to the meeting of the industry and finance ministers with the West Bengal chief minister. It is not yet certain, however, when the meeting will take place. Some observers are sceptical of any positive outcome. It is pointed out that several meetings have already been held but the project has not yet taken off. Evidently the delay is on account of political overtones and there can be no progress without a nod from the highest quarter.

But whatever be the reasons for delaying approval to the Haldia project, there is no denying the fact that the country urgently requires a large-sized petrochemical project to meet the growing demand from manufacturers of a host of industrial goods. Lately, the situation has become desperate. India will have to import large quantities of ethylene, LDPE, polypropylene, styrene and PVC to meet domestic requirements. What is more disturbing is that these products are not easily available in the international market even at exorbitant prices. This is evident from the fact that numerous official delegations have visited producers in West Asia and Europe to ensure supplies of these industrial raw materials, but have met with only limited success.

It is in this context that the need for clearing the Haldia project has acquired added importance.

Even if on account of political differences, the Central government is not inclined to give the project to West Bengal, it will do well to approve a similar project in an eastern region state considered more suitable.

A petrochemicals project in the eastern region is a necessity since so far all such projects have been set up on the western coast like the IPCL complex at Baroda and the Maharashtra Gas Cracker Complex. The creation of a project in the eastern region will thus help to correct regional disparities.

Unfortunately, even 11 years after issue of the first letter of intent for the Haldia Petrochemical complex fundamental differences between the project authorities and the Central government continue to exist over the size of the naphtha cracker. The cracker, which is the mother unit of the petrochemical complex, was initially approved for a capacity of only 54,000 tonnes of ethylene per annum. This is about the same size as that of NOCIL, a blue-chip company for many years now.

Subsequently, the capacity was enlarged in 1981 at the behest of several government agencies including the Planning Commission and the department of chemicals and petrochemicals. It was then suggested that a viable size for a naphtha cracker would be about 100,000 tonnes per annum and the cracker capacity was fixed at this level. An ideal product-mix for the petrochemical complex was also finalised, taking into account the size of the naphtha cracker, while the public sector Engineers India Limited was entrusted with the task of preparing a techno-economic feasibility study.

Later, the Central government backed out of the project in 1985 and the West Bengal government came on the scene with a private sector partner, the R.P. Goenka group. At this stage, the capacity was further upgraded to 125,000 tonnes per annum. A series of discussions with IDBI followed resulting in another increase in the proposed capacity to 139,000 tonnes at which level the project now stands.

Things became more complex in 1986 when the government came out with minimum economic capacities for various industries including petrochemicals. The minimum economic size for a cracker was fixed at 300,000 tonnes. The controversy over the size of the Haldia project thus hinges on this new stipulation on minimum economic size which was notified, it will be recalled, about nine years after the project was originally conceived.

It is intriguing, however, that the finance ministry continues to have doubts about the viability of the project in spite of the fact that it has been approved by all technical experts including Engineers India Limited. EIL has carried out a techno-economic study establishing the project's viability at the present capacity while the department of chemicals and petrochemicals asked an expert committee headed by the IPCL chairman Mr. Ganguly, to examine this issue. Even after the committee submitted a report in September last in favour of the project, the finance ministry doubts persist.

The delay has already caused a great deal of harm. The bulk of the expenditure on this project could have been recovered in foreign exchange by this time, as this is essentially an import substitution project.

Instead, what has happened in the intervening period is that the project cost has gone up and the country continues to pay a heavy price to import petrochemicals. Besides, efforts to prevent deforestation by greater use of plastics have received a setback with the delay in completing this project.

It will be recalled, in this context that there has been no reply to a letter written on March 30 by West Bengal chief minister Jyoti Basu to finance minister N. D. Tiwari, pleading for a non-partisan approach to the project. In the letter, Mr. Basu even conceded that a fresh look could be taken at the size of the cracker but pointed out that Central government approval is necessary in order to at least begin work on the downstream units.

Despite the flexible attitude being taken by the West Bengal government, the finance ministry is maintaining a studied silence in response to all communications being sent on this subject.

The project authorities are also puzzled over the fact that the latest extension of the letter of intent has been given for only nine months, that is, till September 30 this year. In the past extensions of the LI had been given on a yearly basis. One possible, and optimistic, explanation could be that the government is on the verge of finally according approval and the LI will soon be converted into an industrial licence.

Chemical pollution : further study needed

Well co-ordinated action programmes based on existing technical knowledge can certainly help in reducing industrial accidents. But the long-term uncertainties arising out of chemical pollution of the environment requires further research, says Mr. R. Krishna Murti, chairman of the Scientific Commission for Continuing Studies on Effects of Bhopal Gas Leakage on Life System, New Delhi.

In his keynote paper presented to the national conference on "Safety, health & environment — challenges and choices" on the second day of the session on May, 17 Mr. Krishna Murti hoped that the scientific community could respond adequately and strengthen the government's efforts in this regard.

Mr. Hirak Ghosh, joint secretary in the Union labour ministry, in his paper said that the Factories (Amendment) Act 1987 had been designed to respond to the qualitative and quantitative changes in the social awareness about industrial hazards following the Bhopal gas disaster. The new petrochemical and fertiliser plants, which would come up in different regions soon, would substantially add to the hazardous situation requiring greater vigilance.

Mr. Arun Joshi, vice-president of Hindustan Cocoa Products, felt that the new enactment assumed that directors of chemical plants were uncaring people, but expected such people to protect the oppressed workers.

Mr. P. Sethuraman, director (R&D), PCL said that safety could be ensured only by a committed management. He stressed the need for updating technology, proper sizing of plant and equipment, adequate provision of fail-proof devices and systems, design and implementation.

Mr. V. N. Kholkute, chief inspector of factories in Maharashtra, emphasised the need for compulsory disclosure of information on hazardous chemicals for not only improving the degree of safety of workers, but also of people living around the factory.

Dr. M. K. Pandhe, secretary of CITU, said that presently only the management's nominees were being appointed as safety inspectors. Instead, the trade union's nominees should be appointed, he said. He also demanded that trade

unions be involved in investigation of industrial accidents.

NEW OPPI CHIEF

Dr. S. Agarwala, Vice-President of Rallis India Ltd., has been elected President of Organisation of Pharmaceutical Producers of India (OPPI) for 1988-89.

Mr. P. Gupta, President, Infar (India) Ltd., and Mr. D. K. Bose, President, Burroughs Wellcome (India) Ltd., have been elected Vice-President, says a OPPI press release.

Dr. Agarwala is the first medical doctor to be elected President of OPPI. A Fellow of the Royal College of Physicians (Edinburgh), Royal College of Physicians and Surgeons (Glasgow) and International College of Angiology (US), Dr. Agarwala has done research in neo-natal hypoglycemia and hyper bilirubenemia and has published several research papers.

He was the convenor and organising secretary of the "first Asian symposium on gentamycin" in 1975 and the

"international symposium on recent advances in malaria research" in 1977.

CHEMICAL MISHAPS :

NSC PLEA FOR IMMEDIATE INTERIM RELIEF TO VICTIMS

The National Safety Council (NSC) has appealed to the Union government to make provisions for immediate interim relief to be paid to victims of accidents in chemical industry pending settlement of compensation claims by industrial courts.

In a recent memorandum sent to several Union ministers, the NSC has recommended that a minimum of one lakh rupees should be paid as interim relief to the dependents of those killed in chemical mishaps, and between Rs. 30,000 and Rs. one lakh to those seriously injured.

For this purpose, NSC, which is a recommendatory semi-governmental organisation under the Union labour ministry, has suggested that the government create a special Chemical Industrial Disaster Relief Fund by collections from industries engaged in hazardous processes.

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Chernobyl—Mere Mismanagement Or More ?

There are four nuclear reactors at Chernobyl: it was the No. 4 unit that was involved in the accident. This stricken fourth reactor has since been completely encased in concrete and Units 1 and 2 have resumed production.

The physical reason for the disaster at Chernobyl is simple and quite straightforward: it was caused by improperly-conducted tests on a generator at the power station to see how long it could provide energy after a shutdown. Ned Franklin(1) has given us a very straightforward account of the accident and he quotes the official statement on this: 'the working programme of tests . . . was not prepared and agreed in the proper manner'. He also tells us that 'the staff over-rode the emergency protection signals'. As Ned Franklin himself concludes, 'the prime cause of the accident was undoubtedly disregard by operators of standing instructions, both in relation to operating the reactor and to disconnecting the protection system'. There is then no doubt that the accident was wholly due to mismanagement. Chernobyl is not the first nuclear installation to suffer a hydrogen explosion: Three Mile Island is another. The reason for the accident there was precisely the same: mismanagement, though fortunately the consequences were not as disastrous as at Chernobyl.

Let us not forget that accidents such as these are lurking round the corner at every nuclear power plant anywhere in the world. This, indeed, must be the lesson from Chernobyl, Three Mile and other disasters including the worst ever tragedy at

Bhopal. I see two crucial lessons from the past disasters. The first is the need for discipline in the workforce. All rules, not only the rules relating to safety, should be obeyed at all times and it is the responsibility of the manager to see that it always is so.

The manager must not relax discipline to avoid trouble, as is so very often done these days. It was reported very early on(2) that four senior officials at Chernobyl had been sacked, while others faced criminal charges. The reporter who brought this news, musing on what would happen in a similar situation in the UK, avers: 'There would be no sackings. No charges.' But, fortunately, he has been proved wrong.

The manager **must** manage. The best way to ensure discipline is not by threat, but by having a well-informed workforce. If people are well-motivated they will at least **try** to "do it right." As one writer on management subjects put it(3) :

The task is not to change people. People are perfectly alright the way they are. The task is not to motivate people. People are inherently self-starting. The task is to remove those things that demotivate them, to get them out of their way.

So the good manager will keep a careful eye on his organisation to ensure that his systems and methods are not a cause of continual frustration and exasperation.

The second lesson comes in the field of what we might call 'public relations'. Not only the workforce, but also the general public should be kept well informed as to what is happening in the plant, whatever the product — and why. In presenting a series of case studies in a recent book, we have demonstrated that the disaster is often made worse by lack of information as to what was going on and what should be done in the event of a crisis(4).

The conclusion we came to is that many sections of industry, and particularly the nuclear and chemical industries are far too secretive. Management must be open. For instance, when a new plant is being built, why not advertise the fact to the neighbours, telling them the ultimate benefits to the community, especially if it is an intermediate product or products. Tell them how they use and enjoy the end product. The "Open Door Day", sponsored by the Chemical Industries Association in the UK as their special contribution to Industry Year, is typical of what should happen.

In the nuclear field, too, British Nuclear Fuels Ltd. have opened their Sellafield nuclear fuel reprocessing plant to public visits. The popular press ridiculed the idea, calling it a 'bizarre tourist attraction'(5), but it is a very sound approach to the problem they have. The writer speaks of the 'sinister shape of Britain's nuclear power industry', and it is this type of adverse publicity that may well make management extremely reluctant to advertise; but they really must. So I recommend managers every-

where to ensure that both their employees and the public (especially those living in the locality) know just what they are doing — and, most importantly — why!

The year 1987 was designated "European Year of the Environment" by the European Commission and CEFIC, the European federation of chemical industry association, organised a European-wide Open Door Day during the year. So you have another chance to participate in an exercise which, whilst it may take up a lot of time, is well worth it. Let the public know what you have done to protect the environment and life and property in the neighbourhood. The Indian chemical industry, I hope, follows suit.

- (1) Franklin, E., 'The Accident at Chernobyl', *The Chemical Engineer*, November 1986, pp. 17-22.
- (2) 'Russia lifts secrecy curtain', *Daily Express*, 21 July 1986, p. 9.
- (3) Bennett, D., *Successful Team Building through TA*, Amacom, New York, 1975.
- (4) Kharbanda, O. P. and E. A. Stallworthy, *Management Disasters and How to Prevent Them*, Gower, 1986.
- (5) Lockyer, D., 'Welcome to sunny Sellafield', *Today*, 14 July 1986, p. 15.

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Sabotage theory of Bhopal carbide plant challenged

Claims that the Bhopal tragedy was caused by sabotage "fails to address a number of important issues and remains the speculative hypothesis" of Union Carbide and Dr. Ashok Kalelkar, who conducted an 'independent investigation' into the disaster, a senior research fellow in criminology has said.

Frank Pearce, senior visiting research fellow, Middlesex polytechnic centre for criminology has challenged Dr. Kalelkar's theory, and said theory had been propounded in March 1985 by a team organised by Union Carbide and of which Dr. Kalelkar was a member.

However, the data upon which the sabotage theory was based has never been released by Union Carbide and thus subjected to a 'truly independent scrutiny' by the scientific community, Frank Pearce has said in a rejoinder to Dr. Kalelkar's claims.

Dr. Kalelkar's argument was that the disaster was possibly due to a saboteur introducing a large amount of water directly into the methyl isocyanate tank and that an alternative explanation of the immediate circumstances of the accident did not withstand even minimal scientific scrutiny.

The other 'explanation' holds out that water gradually entered the tank over a period of time, inadvertently introduced when an inadequately trained, and inadequately supervised, worker did not follow standard operating procedure when washing out a pipe, Frank Pearce said.

One reason that Dr. Kalelkar gave for the implausibility of this explanation, when he presented his paper before a symposium sponsored by the British Institution of Chemical Engineers in London, was that according to witnesses three bleeder valves were open and would have drained away any water.

What he failed to mention, Pearce said, was that according to other witnesses two of these valves were partially blocked and the other completely. Dr. Kalelkar also omitted discussion of many other significant details in-

cluding the existence of another possible route of water to the tank, via a temporary jumper line, despite the fact that Union Carbide had reluctantly admitted its existence right in August 1985, Pearce said.

He said poorly trained operators had become the norm at the understaffed Bhopal facility. Its personnel had been reduced to 650 from its full operating complement of 1,000 and Union Carbide had considered selling off the methylisocyanate plant because of the collapse of the local market for its biocides, sevin and temik.

Frank Pearce said it was well documented that the safety systems were not in operation and would not have been adequate even if they had been functioning. The reason why the accident occurred at all, and why it was so serious, must be sought in corporate policy and practice, not in the acts of some 'disgruntled employees' he said.

Finally let us note that if the accident was caused by sabotage this would itself show how unsafe the plant design was. Apparently it was possible to insert a water hose into a tank of extremely dangerous chemicals by merely removing a dial by hand. If this was so, then the company would be guilty of contributory negligence: under British and Indian law the company would probably be liable for the actions of its employee and for the negative consequences of the operation of such an 'ultra-hazardous commercial venture, the research scholar said.

In reality, he said, if the sabotage theory got established then western political pressure on the Indian Government to settle out of court for a relatively low sum would be greater. (See p. 50 also).

DESALINISATION PLANT FOR GUJARAT

A desalination plant using the reverse osmosis technology for desalinating brackish water to potable water was recently handed over to Gujarat Chief Minister, Mr. Amarsinh Chau-

dhary by the Advisor to Prime Minister, Mr. Rajiv Gandhi on Technological Missions, Mr. Sam Pitroda.

The plant has been developed by the Central Salt and Marine Chemicals Research Institute (CSMRI), Bhavnagar. The plant desalinates 15,000 litres of brackish water per day removing 85 per cent of the total dissolved salts.

The plant comprises of a sand filter, chemical dosing system, reverse osmosis unit, high pressure pump, control panel, decarbonator and ammonia ring equipment.

The desalination process takes place by passing the brackish water through a filter and subsequently a chemical is added for better membrane performance. The filtered water is then passed through the reverse osmosis plant where the separation takes place.

The plant has been designed and fabricated on behalf of the technological mission on drinking water by the CSMRI.

VIETNAM SIGNS PACT WITH HYDROCARBONS

Vietnam has signed a contract with the public sector Hydrocarbons India Ltd. to jointly explore and exploit oil off the southern Vietnamese coast.

Vietnam's national oil company Petro-Vietnam, signed the contract in Hanoi with Hydrocarbons India Ltd., subsidiary of the Oil and Natural Gas Commission, the official Vietnam news agency said.

The contract was signed by Mr. Truong Thien, President of Petro-Vietnam and Director-general of the General Oil and Gas Department of Vietnam, and Mr. S. C. Jatar, Chairman and Managing Director of Hydrocarbons India Ltd.

The first surveys are expected in April, 1989, and the first exploratory well is to be drilled in the following year, the report said.

Under the 25-year contract, the Indian firm will invest exploration capital and train Vietnamese technical personnel in India.

Heavy water plant costly, slow : study

The report of the comptroller and auditor-general (CAG) has criticised the department of atomic energy (DAE) for cost overruns, delays and below target production levels at the Tuticorin heavy water plant, India's largest source of indigenous heavy water. The CAG report for scientific departments, released separately for the first time, says the production performance of the plant has been "far below the anticipated levels" while the total project investment has more than doubled.

Heavy water is a crucial component of the country's nuclear power programme aimed at generating 10,000 MW of power from the atom by 2000 AD through a chain of uranium fuelled reactors which use heavy water as moderator and coolant.

The Tuticorin plant, which has produced 60 per cent of indigenous heavy water, has had an average annual production of only 20 per cent of the installed capacity. And the plant has operated only 1,284 days instead of an available 2,550 days in the last eight years, the report said.

The cost of the heavy water itself has gone up from a DAE estimate of Rs. 4,120 per kg to more than Rs. 13,800, a figure based on the actual average annual production.

According to the report the total capital cost went up to Rs. 4,893 lakhs, a 130 per cent increase over the original projected cost of Rs. 2,761 lakhs.

The shortfall in production has amounted to Rs. 186.67 crores, the report said.

The report said the plant took seven years to build despite the construction time for heavy water plants initially planned to be four to five years.

The delays have been attributed to extra time spent on the completion of structural works, erection of the plant and on fabrication of the equipment.

In a section on the indigenous research reactor "Dhruva", the CAG report said the reactor has not functioned at the designed power levels so far while the production of radioisotopes, a key objective of the reactor, has been delayed.

The Dhruva project took 99 months to complete instead of the projected 55 months and the total expenditure went up, the report said.

The radiation facility for the production of the radioisotope iodine-125 and some basic research facilities had not been established at Dhruva till October 1987, the report said.

The CAG report has charged the department of space of losing five years and investing Rs. 65 lakhs without any benefits because it tried to productionise a product without complete technology.

The product which the report has coded "X", an important component of the polar satellite launch vehicle (PSLV) programmes, was initially developed in the laboratory at the Vikram Sarabhai Space Centre.

To save time the Indian Space Research Organisation (ISRO) skipped the pilot plant stage of the process and tried to convert into an industrial product. This led to snags during attempts to scale up the technology, the report said.

Finally, ISRO had to import product 'X' to ensure that the PSLV programme went ahead uninterrupted.

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List anti-national : IDMA chief

The rumblings in the Indian Drug Manufacturers' Association (IDMA) took an unlikely turn. Mr. Vinnobhai Shah, president of IDMA termed the food and drug administration's (FDA) publication of the list of producers of substandard drugs without the benefit of hearing as 'anti-national'.

Speaking at a press conference, he said the list published by the government will have serious repercussions on export of drugs and may affect the credibility of drugs manufactured in India.

The FDA should first verify things in the right perspective, before they came out with such a list, he said.

Earlier, Mr. Shah had pointed out at least half-a-dozen names of well known pharmaceutical companies which are represented on the executive committee of IDMA and whose names appear on the FDA list of manufacturers of substandard drugs.

The recent tirade by Mr. Shah can be seen as only as an action to patch up with his detractors, though Mr. Shah maintained that every thing is well at IDMA. Two senior members, Dr. Patani and Mr. K. M. Shah have been holding meetings to patch up the matter.

Regarding loan licensing scheme (LLS) where a recent government notification has removed the excise concession to small-scale units, the government has done a disservice to LLS who have brought down prices in the market and also gone to villages.

In all there are 8,000 LLS in the country employing 3,25,000 people, he said.

According to Mr. Shah, a loan licensee is a manufacturer of drugs in his own right and manufactures his drugs under his brand name utilising the spare capacity of an approved SSI unit.

In a memorandum to the government, the IDMA has requested the government to treat SSI loan licence units as independent manufacturers and also restore the excise benefits that are granted to small-scale units.

Mr. Shah blasted the government for its indiscriminate hiking of excise duty on drugs. Today a customer pays 63 paise for every rupee he pays for a drug as excise duty, he added. This has led to the profitability of drug

companies coming down to 3.5 per cent, he said.

The press conference which was called by Mr. Shah was later on questioned by the IDMA, general secretary, Mr. N. I. Gandhi who said that any comments made by Mr. Shah should not be taken as official views of IDMA.

Mr. Shah also categorically stated at the meeting that he was not against quality control and in-house testing laboratories, on the other hand the IDMA memorandum to the ministry of health, upholds the quality control of drugs and medicines. A third party analysis, is the best condition to maintain quality of drugs and medicines, he said.

As far as the small-scale units are concerned it will be impossible for them to set up in-house testing centres in the stipulated period given by the government, he added. Instead the government should help in the setting up of testing laboratories in the cooperative sector similar to the one set up in Madras.

SMALL DRUG UNITS: PLMA AGAINST COMPULSORY LABORATORY

The Pharmaceutical Loan-licence Manufacturers Association (PLMA) has joined issue in the on-going controversy, prevailing among members of Indian Drug Manufacturers' Association (IDMA), regarding compulsory inhouse testing laboratory facilities for small-scale pharmaceutical units.

PLMA, which claims to be the national spokesman of 70 per cent pharmaceutical manufacturers in the country, has pointed out that small-scale drug manufacturers cannot afford such laboratory facilities as it becomes economically unviable for them to invest Rs. 3 lakhs or more. And even if they were to do so, it would be an idle investment because most of the tests require spectrophotometer and IR which they have to carry out at independent testing laboratories.

The president of PLMA, Mr. S. A. Pandya, talking to newsmen, threw an open challenge to Mr. N. I. Gandhi, secretary of IDMA, to convene a special general meeting of the association to ascertain the views of the members whether they favour in-house testing laboratory facilities for themselves

or not. This would for once and settle the controversy, he said.

Mr. Pandya said it is the malafid design of big houses to reduce the competition by making in-house testing laboratory compulsory for SSI manufacturers who then will either have to close down or will make idle investment and lose their thin profits.

He pointed out that in the recent past most of the drugs declared substandard by the FDA in Maharashtra belong to companies having in-house testing laboratory and incidentally, most of them are IDMA executive committee members.

IPCL OUTPUT EXCEEDS TARGET

The production in Indian Petrochemical Corporation Ltd. (IPCL) was 26 per cent higher than the target for the month of April, 1988, touching 40,000 tonnes against the target of about 31,000 tonnes.

An official release quoting IPCL said that for the month of April, the profit before depreciation and tax was Rs. 6.50 crores against the action plan figure of Rs. 4 crores. The profit before depreciation and tax in the corresponding period of the previous year was Rs. 1.50 crores.

The internal resources generated for the month was Rs. 6.30 crores as against Rs. 1.50 crores in the corresponding period of the previous years. The gross sales turnover during the same period was Rs. 49.06 crores against the action plan figure of Rs. 40.03 crores as against Rs. 30.48 crores in the previous year.

MORE RETAIL OUTLETS FOR FERTILISERS

A number of steps have been taken to expand the network of retail outlets for the supply of fertilisers at uniform prices.

Under the lead fertiliser supplier system, districts and State lead fertiliser suppliers have been identified to undertake various fertiliser promotional programmes, including opening of additional retail outlets for the supply of fertilisers in each district.

There was also a provision to open 200 additional fertiliser retail outlets in each of the 60 districts selected under the "national project on the development of fertiliser use in low consumption rain-fed areas" programme.

These retail outlets will be opened through co-operatives. A subsidy of Rs. 1,200 will be extended to each additional retail outlet.

Plastic resins team on global tour

A high-powered delegation led by Mr. Lalit Doshi, Joint Secretary, Ministry of Industry, took off on a global tour in search of stocks for the proposed plastics raw materials bank.

The team includes managing directors of IPCL, NOCIL, PIL and representatives of processors and the State Trading Corporation. They will meet manufacturers in Europe, North and South Americas and the Far East.

An earlier team led by Departmental Secretary H. K. Khan was able to contract about 35,000 tonnes of LDPE. The most critical shortage is that of HDPE which goes into myriads of consumer durables. It appears American suppliers have indicated that they are not keen on spot sales but are willing to consider long-term contracts.

The Government, it is learnt, is yet to finalise its ideas about the proposed bank — who will finance it, where it will be located and the like. In all probability, IPCL will be entrusted with the distribution of imported polypropylene (PP) in addition to LDPE. Similarly, PIL, the sole producer of HDPE in the country, may be asked to distribute the imported raw material and NOCIL, the leading indigenous producer, may be asked to distribute imported PVC.

If this works out, it may mean a change in policy which presently disallows manufacturers to import materials for others' use. Consuming industries are keen on avoiding the cascading margins which swells the prices of STC-imported materials at present.

STC now charges a four per cent commission on imported material before handing over the material to IPCL which in turn adds its service charges. The pooling system means an added 10 per cent sales tax burden. As a result, the end-price balloons by 16 to 18 per cent. With international prices jumping like circus acrobats, the impact on consuming units, the bulk of whom are in the small sector, can well be imagined.

INPUTS PAUCITY HITS PLASTICS INDUSTRY

The plastics industry is at the crossroads owing to shortage of raw materials and operative restrictions imposed by the Government, according to the Raw Material Committee Chairman of the TN Plastics Manufacturers Association, Mr. B. Swaminathan.

Presiding over the inaugural session of a four-day skills upgradation training programme for plastic processors organised by the Industrial and Technical Consultancy Organisation of TN (ITCOT) and the manufacturers' association, he said that the industry's profit margin is under pressure from "Stiff raw material prices."

While primary lending institutions took immediate note of operative restrictions, they tended to move slow

when orders regarding their relaxation is received, he said.

Inaugurating the programme, Mr. S. Ganesh, Deputy General Manager of IDBI said that similar programmes would follow for specific groups of industries if the present one proved useful to "more than 50 per cent of the participants." This is the first programme of its kind in Tamil Nadu.

The Chairman of the Indian Plastics Institute (Madras Chapter), Mr. Y. J. Jayakumar, said that the industry would take two years to overcome the crisis arising from the shortage of raw materials. By then the raw material availability would have doubled providing scope for the rapid growth of the industry.

Many in the industry did not have a thorough knowledge of plastics. Plastic processors should aim for excellence and keep themselves informed about current technological developments in the industry. He announced that the institute would be conducting a two-day introductory course on plastics on June 10.

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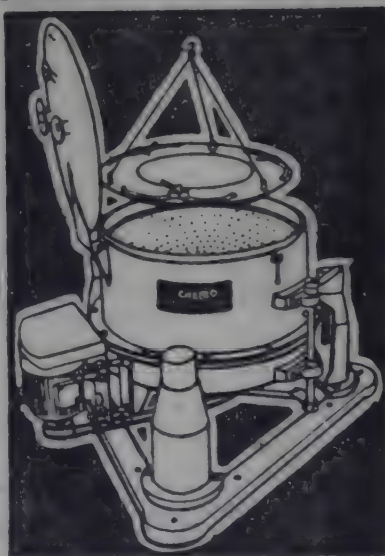
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HOUSE TESTING FACILITY :

Bombay HC stays FDA

The Bombay High Court has stayed the Food and Drugs Administration (FDA) from proceeding against member units of the Small Drug Manufacturers' Organisation of India (SDMOI) for not having inhouse testing facilities.

The court has also admitted writ petitions from the SDMOI and some of its members which had challenged the validity of penal actions initiated by the FDA against the defaulting drug manufacturers.

Disclosing this at a press conference in Bombay on May 13, Prof Anant Namjoshi, president of SDMOI, said that his organisation fully supported Mr. Vinooobhai Shah, president of Indian Drug Manufacturers' Association (IDMA), in his current endeavours to get the mandatory provisions in respect of inhouse testing facilities withdrawn.

SDMOI has taken this stand because inhouse facilities are no guarantee against production of substandard drugs, as had been proved by the recent disclosures in the FDA's lists. The only guarantee is objective testing by approved public testing houses. Inhouse facilities presupposed availability of adequate funds, qualified personnel and, above all, an unimpeachable integrity on the part of both such personnel and their employers. And all these are rare resources.

Besides, it would be an impossible task for the FDA to conduct effective and frequent inspections of the inhouse facilities of over 3,500 drug units in Maharashtra and similarly large number of them in other states. It is a common experience that frequent inspection visits to these facilities by officials would open floodgates of corruption.

On the other hand, if the mandatory testing is confined only to some 50 or 100 approved public testing facilities — of which there are about 35 in the country and 20 in Maharashtra alone — the frequency and quality of ins-

pections could be maintained at a high level to deter malpractices.

He said that the big units' apprehension of huge inventory build-up pending test reports from the public testing facilities would have no scope, if the number of such testing houses are increased sufficiently and the procedures are streamlined.

Prof Namjoshi declared that his association would vouch for the high quality of products of its member units if only the government agrees to objective third-party testing, instead of inhouse testing. He also criticised IDMA for not taking action against its member units, who are being frequently mentioned for production of substandard drugs in FDA's list. "It should dismiss such members" he said.

Mr. Pratap K. Mehta, hon. general secretary of SDMOI, said that many large pharmaceutical companies in Punjab, Delhi and Bengal have been dispatching with impunity even highly sensitive drugs like ampicillin and sera vaccines to Bombay without the aid of refrigerated containers in trucks or rail wagons. Most often, such cargoes are in transit at least two to three weeks and then are dumped in godowns for further long periods before reaching the distribution points.

He also alleged that many multinationals were violating the legal provisions by buying commercial grade — not Indian pharmaceutical grade — raw materials like acetic acid, boric acid, citric acid, glycerine, sodium bicarbonate, magnesium sulphate, zinc oxide, castor oil, etc. Neither the government nor the FDA was doing anything about it he said.

PPCL PROJECT TO GO ON STREAM IN OCTOBER

The first chemical phosphatic fertiliser project in the country, being taken up by the public sector Pyrites, Phosphates and Chemicals Limited (PPCL), at Amjhore in Bihar, will be commissioned in October next.

The Rs. 65-crore unit with an installed capacity of 320 tonnes of sulphuric acid and 800 tonnes of single super phosphate (SSP) fertilizer a day, would help the country to effect a foreign exchange saving of Rs. seven crore.

The PPCL project will be the first attempt to produce sulphuric acid and phosphatic fertiliser from the indigenously available iron pyrites. So far, the requirements for these two items have been through imports in the form of acid or mined phosphates.

PPCL has pioneered the development of indigenous pyrites found in large quantities at Amjhore (Bihar) and Saladipura (Rajasthan) and the rock phosphate deposits in Mussoorie in Uttar Pradesh. The Mussoorie sedimentary rock phosphate is already marketed by the company as "Mussoorie phos" for use by farmers as fertiliser and soil amending agent.

PPCL estimates the rock phosphate deposits around Mussoorie in the Himalayas to be 45 million tonnes. During 1987-88, PPCL produced and marketed 130,000 tonnes of Mussoorie phos.

The Amjhore pyrite deposits of 275 million tonnes of sulphur equivalent with the PPCL is estimated at Rs. 57,200 crore. The Saladipura deposit estimated at 120 million tonnes of medium grade pyrite is valued at Rs. 5,200 crore.

PPCL has already started marketing its single super phosphate (SSP) fertiliser under a seeding programme in Bihar, Delhi, Uttar Pradesh and West Bengal under brand name "sone ganga khad." This will be reinforced when the Amjhore phosphatic fertiliser project is commissioned next October. Its second phase is expected to be ready in 1989.

PPCL's sales turnover of Rs. 17.74 crore in 1987-88 recorded an 18 per cent growth over the previous year. The company's net profit at Rs. 85.35 lakh in 1987-88 was also marginally higher than that of last year.

PPCL has many diversification plans such as production of elemental sulphur, magnets, marbles, granites and pigments from pyrites.

Carbide's sabotage theory 'intriguing'

Scientists and other groups, keenly following the controversy about the causes of the 1984 Bhopal gas disaster, are intrigued at the timing, venue and manner in which Union Carbide has sought to present a report from its American consultants reiterating its pet theory of sabotage as the cause of the disaster.

The report was presented at the three-day conference of the Institute of chemical engineers, London, by an Indian representative on behalf of Arthur D. Little, which investigated the causes over a period of one year. The report, it was said, was prepared by an independent source even though the consultants were hired by Union Carbide, one of the main parties to the dispute facing huge penalty payments for negligence.

The media was briefed in advance by the Union Carbide media consultants in the U.S., Britain and India even though the paper was not given in advance to those attending the meeting. This did not give a chance to the Indian scientists or the government of India or the Bhopal action group, London, to question the findings by the consultants or enable the scientists attending the meeting to discuss the paper.

The paper was presented for 45 minutes. But only five minutes were allocated for questions during which only two questions were taken up. All inconvenient questions were brushed aside.

The report presented by Dr. Ashok Kalelkar said with virtual certainty "that the cause of the accident was sabotage by a disgruntled employee who would be named at an appropriate time". He said that all the employees on duty at the time of the accident colluded in the cover-up. He said the only witnesses who could be described as reliable were those who were not present at the time of the accident and who were traced by Union Carbide at great expense and after great effort.

The report neither referred to the safety flaws in the plant nor did it re-

fer to the fact how any one could cause such a serious accident easily.

The scientific evidence which led Dr. Kalelkar to conclude that sabotage was the cause of the accident was not disclosed.

Mr. David Bergman of the Bhopal action group described the report as a completely flawed attempt by Union Carbide to escape the moral, legal, and financial responsibility for the disaster. According to him, serious technical flaws existed in the plant and the company had failed to follow safety procedures.

He referred to the decision to store large quantities of the volatile and highly toxic methyl isocyanate gas (MIC) on site — a practice rejected by both Bayer and Union Carbide's subsidiary in Beziere, France. The refrigeration unit designed to keep MIC at the required temperature was out of action five months before the accident and two other safety features, the vent gas scrubber and the flare tower, were also not in operation.

Union Carbide is being prosecuted in India for \$3 billion. The Government of India, the Council for Scientific and Industrial Research and other bodies have taken the plea that the cause of the accident was the plant which had serious flaws and was in disrepair.

While Union Carbide maintains that the gas leak which caused the disaster was due to sabotage by an employee, the M.P. high court has ordered Union Carbide to pay interim compensation of about \$160 million. The high court has upheld the prosecution's case that there was prima facie evidence of negligence on the part of the company.

INDO-SOVIET TIE-UP TO DEVELOP TITANIUM FILTERS

Soviet and Indian scientists will collaborate to develop titanium filters for industrial and drinking water.

The study project will simultaneously be taken up at the Byelorussian Powder Metallurgy Association (BPMA) in Minsk (USSR) and the advanced powder metallurgy research and development centre to be set up at Hyderabad.

The BPMA Director General, P. Oleg V. Roman said that this would be one of the more than 69 projects identified at the first meeting of the Indo-Soviet joint council for the integrated long-term programme (ILTP) of cooperation in science and technology in New Delhi last year.

Titanium oxide ore is found in abundance in both India and the USSR.

Prof. Roman said powder metallurgy technology has a big potential therefore the two countries have decided to take up joint research studies in this field.

Titanium has a bright future. Titanium filters will not only solve community water problem prevalent in the Soviet Union and India but also provide an industrial system to produce water filters, he said.

He regretted that the two countries at present did not have an economic industrial system to produce community water filters.

He said a Soviet delegation had visited Hyderabad in March this year in connection. An Indian delegation of scientists will arrive in Minsk in a month or in the first week of next month to be followed by another Soviet delegation's visit to Hyderabad to commence research work, he said.

According to Prof. Roman, the project would be set up at his institute in Minsk and they would co-ordinate research work with their Indian counterparts at Hyderabad.

ILTP signed between the two countries last year envisages collaboration between 70 Indian and an equal number of Soviet laboratories and research institutions. The thrust areas of research are biotechnology and immunology, materials science and technology, laser science and technology, catalysis, space research, synchrotron radiation technology, water prospecting and computers and electronics.

In addition, basic research will be undertaken jointly in selected areas of pure and applied mathematics, earth sciences, radio physics and astrophysics, ecology and environment, chemical engineering and metallurgy.

Flowmore Polyester to go on stream in July

Flowmore Polyester Ltd set up at a cost of Rs. 24.15 crores, as a joint venture unit with the U.P. State Industrial Development Corporation (PSIDC) at Kashipur in Nainital, will begin commercial production in July this year.

The four-decade-old Delhi-based Flowmore Group, consists of Flowmore Pvt. Ltd, Fairbanks Morse India Ltd, Ushamil Pvt Ltd, and Total Engineering Services Pvt Ltd. The group has the distinction of making good profits and Flowmore Polyester Ltd. is a major diversification being the first unit in the group to go public.

According to Mr. M.P. Gupta, Managing Director, Flowmore Polyester Ltd, and Chairman of the Flowmore Group, due to the spectacular expansion being witnessed in the electronics fields such, as audio, video and computers, great demand is developing for biaxially-oriented polyester film (PETP).

Mr. Gupta told the press that with the rapid growth of the processed food industry, a great demand is being created for proper quality films for packaging. The group is prompted to manufacture biaxially-oriented technical-grade polyester film which is the basic raw material for these products.

To part-finance the project, Flowmore Polyesters will shortly enter the market with a public issue of 45 lakh shares of Rs. 10 each for cash at par, aggregating Rs. 4.5 crores. Promoters contribution of Rs. 3.19 crores has already been put in. The plant at full capacity will make PETP of 4,000 tonnes per annum. The unit is expected to operate at 60 per cent capacity utilisation in the first year, 75 per cent in the second and 95 per cent in the third. The break-even point is 60 per cent of the capacity.

The demand for polyester film has gone up from 9,300 tonnes in 1987 to 10,950 tonnes in 1988. It is expected to be 13,100 tonnes in 1989 and 15,550 tonnes in 1990. The country's installed capacity is 13,400 tonnes. However, taking the average capacity utilisation at 85 per cent, polyester film output will come to 11,390 tonnes. Even with Flowmore entering the market with a production of 3,840 tonnes per annum (at 85 per cent capacity

utilisation), there will exist a demand-supply gap of 896 tonnes.

Didier Engineering of West Germany has supplied know-how to Flowmore. Didier will be making available Celfa technology of Switzerland for the product. The company has also given financial performance guarantee for satisfactory operation of the plant. Cellier SA of France has supplied plants to other international manufacturers of polyester films such as Du Pont, Kodak and 3M of the U.S. Flowmore will also have continuous access to any development by Didier Engg.

Mr. Gupta said Flowmore Polyesters will have a gross cash generation of Rs. 5.24 crores in the very first year of operation and in three years the project will pay for itself. The demand for polyester film is growing at the rate of 25 per cent per annum.

Even before commencement of production, Flowmore has a firm export order from Xebec of the U.S. for 600 tonnes of polyester film per annum from 1988. This is over 30 per cent of production in the first year, Mr. Gupta added.

SUNBELT-IDIL PLANT STARTS PRODUCTION

Sunbelt Corporation, a joint venture floated by Indian Dyestuff Industries Ltd (IDIL) in the US has commenced production.

The project, located in Rock Hill Industrial Park, South Carolina, was inaugurated on May 5 at a function attended by the State Governor.

The joint venture, in which IDIL and its associate concerns have 40 per cent stake, is being described in industry circles as a "giant leap for the Indian company."

IDIL belonging to the Sungrace Multifacial Group, a leading exporter of dyestuffs, took advantage of the closure of dye divisions of local American units, following acute shortage of imported crude dyes. The basic crude dyes are not manufactured in the US. At the same time, there is a growing demand for these dyes from the textile industry.

Sunbelt Corporation is assured of its requirements of crude dyes from IDIL and will use IDIL's well-known

brand names. The project is located near important textile centres, ensuring low freight costs and easy distribution.

IDIL obtained approval for the joint venture in February 1988. In March, the company received Reserve Bank sanction for remittance of subscription towards equity participation. The equity capital has been remitted through the normal channel and there has been no irregularity at any stage, a company spokesman said.

Sunbelt is the second joint venture promoted by IDIL. The first, Matangi Dyestuff Industries Ltd., was set up in Thailand in 1980 and now caters to the requirements of Thailand neighbouring markets in South-East Asia, Far East and Australia.

MRTPC RESTRAINT ON ROCHE PRODUCTS

The Monopolies and Restrictive Trade Practices Commission has restrained Roche Products Ltd., a Bombay-based pharmaceutical company, from making tall and false claims to promote sales of capsules to pregnant ladies suffering from iron deficiency or anaemia.

The company was found to be claiming in its medical journal that the addition of 200 mg of ascorbic acid (vitamin C) would yield a six-fold increase in the absorption of iron.

However, investigations by the Director General of Investigation and Registration revealed that a misleading impression was being created on consumers that iron absorption almost trebled when only 25 mg of ascorbic acid was taken. It was found that the presence of 200 mg of ascorbic acid increased the absorption of medicinal iron by only 30 per cent in contrast to the company's claims.

The drug controller has opined that there were other sources for enhancing iron absorption and that the addition of 200 mg of ascorbic acid may have side-effects.

While granting the ex-parte stay order, the Commission Chairman, Mr. Justice G. R. Luthra and Mr. S. D. Manchanda, member have observed that if the injunction is not granted, the respondent is likely to continue with unfair trade practice consisting of false and misleading and advertisements.

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a rapid wrap-up of what's new in operations, processes & products

Oxygen enrichment with polymeric membranes: Molecular Design of polymers

Y. Kawakami and Y. Yamashita have given different approaches to the molecular design of polymers for selective oxygen permeable materials. The use of polymers of semi-rigid main chain with oligodimethylsiloxanyl substituents and utilization of surface modification by accumulation of surface active graft copolymers seems to be quite promising. Oxygen separation from air by carrier compounds has also been considered and even 88% pure O_2 has been obtained. Attempts to increase diffusion coefficient and solubility are still being made. Thus by making the micro-phase separated permeation channel (which will show high diffusion coefficient) from graft co-polymers containing PDMS and mechanically strong polymers we may be able to realise better results. (*Memoirs of Faculty of Eng., Nagoya Uni.* 1987, 39, No. 1, 62-91).

Kuraray has developed a new hollow fiber for O_2 enrichment to 28%. The operation cost of this new design is only 50% of the earlier designs. Polysulfone fibers with internal coating of a silicone are used.

In USSR a new hollow fiber based on poly-4-methylpentene-1 has been developed (o.d. = 75-80 microns; wall thickness 25 microns) which is good for oxygen enrichment and 45% O_2 content of nitrogen can be reduced to 5% so that such a gas can be used for storage of fruits, vegetables, etc. (*Fibre World*, 1987, Sept. 177-178).

A new type of polyimide fiber for gas separation has been patented in Japan (Jap. Pat. 61-19813, *Cf Fiber World* 1987, Sept., p. 158). A considerable improvement in $H_2 + CO$ separation has been claimed. Aromatic polyimide co-polymers based wet spun fibres have been used.

Synthetic Fibres

Enka have developed an aramide fiber which is good for concrete; this fiber is stronger than steel and completely resistant to corrosion (*Fiber World*, 1989, Sep. p. 170).

Different types of fibers can be used to substitute

asbestos. Thus aluminium silicate fibers are good. Silica fibers and yarns have also been made by Enka. (*ibid*, pp. 173-175).

Teijin has developed a new sweat-absorbing polyester fibers which absorbs sweat without the unpleasant feeling of chill and sticking. The surface of this branded "Wellkey" fiber shows micropores of 0.01 to 3 microns. Thus capillary action is promoted for the transport of moisture. These are particularly good for underwears. (*ibid*, pp. 176-177).

Separations: New directions for an old field

A recent A.I.Ch.E. Monograph Series (Keller, Vol. 83, No. 17, pp. 1-52) gives an exhaustive account of this subject which is so crucial in chemical and allied industries. This one author series discusses, among other topics, innovative directions in which separation science and technology (SST) are going, larger vision of the bounds of SST. Examples of separations from several industries, including microelectronics, food processing, etc. are given; a figure gives the scale of production for coal cleaning at the rate of more than one million Kg per hour to radioisotopes at the rate approaching 5×10^{-7} kg/hour for high-value radioisotope.

Distillation continues to be the most important separation process and we continue to witness developments in this area. Even then the energy consumption is 10 to 100 times more than the value predicted thermodynamically. Energy "integration" or "sharing" is now being practiced on a large scale; an example of ethylbenzene-styrene separation is given. Required selectivities at equal cost for distillation, extractive distillation and solvent extraction are (separation factor) 1.2, 1.4 to 2.8.

Alternative to distillation are discussed at length and importance of innovation research has been stressed. The use of a mass separating agent (MSA) has been considered at length; MSA's can be solids, liquids or gases. Amongst solids the use of adsorbents and ion exchange resins may be referred; ZSM-5 and silicate are new types of hydrophobic molecular sieves and molecular sieve car-

bons are now available which selectively adsorb oxygen from oxygen-nitrogen mixtures. It is understood that even alumina surface can be modified to change selectivity. Kureha of Japan has a new activated carbon in the form of extremely rugged microspheres called bead activated carbon which has been very useful for removing impurities from gases. Polymeric sorbents and ion exchange resins are now used widely and even high-fructose syrup is amenable to enrichment. Polymeric sorbents with size-selective sorption properties have been developed e.g. polyacrylamide gels which adsorb small molecules like water, urea but exclude macromolecules, proteins, microorganisms etc. Liquid inclusion compounds constitute an exciting area. Gaseous MSA are typically supercritical gases.

The development of MSA's using two selectivity-generating methods simultaneously seems to be an interesting and potentially rewarding area.

There is an interesting section on scale-down of separation processes. Typical examples are in biomedical uses; personal and health products, etc.

Catalytic distillation column reactors are being developed e.g. for MTBE from mixed butenes.

Human body continues to inspire new methods of "fine" separations.

Electromembrane process (EMP)

An EMP has been developed which minimizes the fouling or blocking that affect spiral wound, tubular hollow fiber and plate and frame membranes. A d.c. field is superimposed on top of an existing membrane system. This enables particles to remain suspended rather than get deposited. (*Chem. Eng.*, 1988, March 28, p. 15).

Dished Electrode Membrane Cell (DEMC)

D. Hughes has given description of a patented cell with a narrow electrode gap, which is nominally 4 mm either side of the membrane and 4 mm between electrodes for an undivided cell. The dishing of the electrode enables a thick cell frame to be used. High electrolyte flow rates can be accommodated to realise high mass transfer coefficients.

DEMC can be considered for small scale NaOH/ Cl_2 /NaClO₂/iodate production; reduction of aromatic nitrocompounds; conversion of oxalic acid to gly-

oxalic acid etc. (*Speciality Chemicals*, 1988, p. 1).

New Synthetic routes to old molecules

T.W. Bastock (of Contract Chemicals Ltd., U.K.) has given a good account of new strategies in conducting nitrations, Friedel-Crafts reactions, oxidation etc. The use of supported reagents can bestow many benefits. Thus reagents supported on clay showing powerful acidic properties can change isomer ratios in nitrations.

KCN/NaCN supported on alumina can provide areas as large as 100 m²/g. Further ultrasound can change the source of reaction of benzyl bromide with toluene, in the presence of KCN -- we may get benzyl cyanide or benzyl toluenes. A similar treatment is given for thiocyanations.

The use of Clayfen (supported ferric nitrate in acetone on montmorillonite) gives high para derivative when phenol is nitrated. Further oxidation of 4-hydroxy benzaldehyde is absent during its nitration; ferric nitrate without a clay support does not react.

Supported AlCl₃ has been used to react benzene with benzyl chloride to give diphenyl methane. Acidic clays are used for alkylations of phenols; FeCl₃ on clay gives 'Clay Fec' which shows some remarkable results.

A particularly interesting example is chlorination of toluene with *tert*-butyl hypochlorite (in turn obtained from *tert*-butanol and NaOCl) on silica/zeolite which gives predominantly *para* isomer. (*Speciality Chemicals*, 1987, p. 383).

Cyclodextrins (CD)

M.A. Parrish has given a useful review of CD where the beta variety is the most accessible, lowest price and most useful amongst alpha and gamma varieties. These CD form inclusion complexes. Japan leads in the use of CD and currently 600 tpa is used; most of this is used in food processing and microencapsulation of drugs is possible. The use of CD for chemical reaction control is now receiving attention. Phenol reacts with CCl₄, in the presence of Cu, and Beta CD to give 100% 4-Hydroxy benzoic acid (otherwise only 55% is realised).

CD have been used for separations. CD has been

used even for waste water treatment. Even gas absorption has been conducted in aqueous solutions containing CD. (*Speciality Chemicals*, 1987, p. 366).

Acetic acid + anhydride

Daicel have claimed that methyl formate and methyl acetate, in the presence of CO, Rh based catalyst and several additives, allows more than 50-50 mixture to be made. (*Chem. Abstr.*, 1988, 108, 94069).

Benzene to phenol: Role of surfactants

It has been claimed that benzene reacts with H_2O_2 , in the presence of iron salts and trimethyl acetyl ammonium bromide, to yield 82% phenol with 100% selectivity. In the absence of the surfactant yields of only 8 to 10% are realised. (USSR Pat. 1268562 *Cf Applied Catalysis*, 1988, 36, p. 344).

Biochemical conversion of substituted benzenes to corresponding catechols

Johnston and Ranganathan have shown that *Pseudomonas* ST-12 can convert substituted benzene to the corresponding catechols via dihydrodiols. Even halobenzene or benzo nitrile can be used. However, nitrobenzene does not react. Catechols with substitution in the 3-position are the presumed products from monosubstituted benzenes. (*Enzyme Microb. Technol.*, 1987, 9, 706).

Thermostable *beta* amylase

Zeikuo and Hun have claimed that *beta* amylase, substantially free of saccharidase activity, obtained from *Clostridium thermosulfurogenes*, shows medium activity at 75°C and is stable upto 80°C in the presence of substrate. (U.S. Pat. 4,647,538, March 1987, *Cf. ibid*, p. 755).

Plate Heat Exchanges (PHE): Graphite-Fluoropolymers

Sigri (W. Germany) and Alfa Laval (Sweden) have introduced a new PHE constructed from a material combining graphite with fluoro-polymers which can withstand HCl, HF, H_3PO_4 , etc., and operate upto 24 °C and 6 bar. This PHE requires 50% of the area required by graphite blocks. (*Mtg. Chem.*, 1988, Jan., p. 5).

Gas scrubbing plants: Aerosol formation

K. Schaber has explained as to under what conditions aerosols can occur and how its formation can be prevented and which gas scrubbers are appropriate for a combined gas-1 aerosol separation. (*Chem. Ing. Tech.*, 1987, 59, No. 5, 376-383).

Oligomerization of ethylene to alpha olefins (AO): Improved product distribution

Chevron (which took over Gulf) has come out with an interesting patent where methanol-water is used as a solvent for oligomerization, in the presence of a Ni-ylide. There are claims for several advantages of the proposed solvent w.r.t. selectivity for higher olefins, ease of separation, etc. A typical product pattern is as follows:

C_6 24.26, C_8 23.35, C_{10} 18.25, C_{12} 12.48,
 C_{14} 8.4, C_{16} 5.26 and C_{18} 3.04%.

(This product pattern is very attractive as hexene is becoming very popular as a co-monomer for LLDPE). (U.S. 4,711,969, Dec. 1987, *Chem. Abstr.*, 1988, 108, 77632).

Sulfonation of Anthraquinone (AQ): Higher selectivity for *alpha*-derivative

It has been claimed that a Pd catalyst, treated with HNO_3 , gives high selectivity for the *alpha* derivative; selectivity for sulfonation with oleum gives 93.5% vs. 67.8% without Pd. (U.S. 4,711,743, Eec. 1987, *Chem. Abstr.*, 1988, 108, 77633).

Polymeric adsorbents for CO_2 based on Cu-alkanolamine complex

A PTFE porous membrane can be coated with a polymer prepared from reaction product of epichlorohydrin-ethylene oxide co-polymer and Cu perchlorate and MDEA and dimethyl acetamide. This membrane shows absorptivity of 0.51 moles of CO_2 /mol. Cu (II). (JP 62,241,551, Oct. 1987, *Chem. Abstr.*, 1988, 108, 78023).

Sugar for chemicals; Purification in sugar plants

The world wide production of sugar is now 115mtpa which gives a surplus of about 15 mtpa. HFCS is gaining ground and this accounts for 50% of the U.S.A. sugar market. Attempts are now being

directed towards making chemicals based on sucrose. Cuba has been moving cane derivatives and by-products into animal feeds at the rate of more than 10% per year for the past five years; Cuba is now looking into chemicals like lysine, furfural, citric acid, surfactants, etc. based on sugar industry. Swedes are looking into biologically active carbohydrates. Xantham gums are now doing well. (*Chem. Eng. News*, 1987, 7 Dec., p. 9-13).

Mazer Chemicals (Illinois, U.S.A.) have developed a chemical clarification system which allows decolorization and removal of non-sugar solids; the use of sulfur is avoided. Higher yields of sugar are claimed. (*Chem. Week*, 1988, 4th Feb., p. 16).

Purification of liquid ethylene dichloride (EDC)

EDC contains dissolved HCl, Fe^{3+} and a small amount of water. For subsequent storage and processing it is necessary to remove HCl and Fe^{3+} . Sood and Fleming (of ALCOA) have shown that a chemically modified alumina is good for removing these impurities to 1 ppm level; residual water is also reduced. Regeneration techniques have also been suggested. (*AIChE Symposium Series*, 1987, Vol. 83, No. 259, p. 40-51).

Cooling Towers (CT)

R. Burger, who has published a book on CT Technology, has brought out the value of properly engineering and maintaining CT. A drop of 0.6°C in the outlet water makes a lot of difference. Efficient distribution of liquid and gas and proper maintenance of packing are important. PVC piping and ABS non-corroding square spray patterns are now used. Super efficient cellular fills, made out of thermoplastics, constitute good packing. (*Energy Progress*, 1987, 7, 1986).

Polysulfide by PTC terpolymerization of malonitrile, CS_2 and α, α -dichloro-p-xylene

Suh et.al. have shown that benzyl triethyl ammonium chloride acts as a good PTC for this terpolymerization reaction. (*J. Polym. Sci. Part C: Polymer Letters*, 1988, 26, 83-87).

Methanol to formaldehyde: vapour phase with nitric acid

Mitsui have claimed that at 250°C , in vapour phase, MeOH reacts with HNO_3 , in the presence of $\text{V}_2\text{O}_5/\text{SiO}_2$ catalyst, to give HCHO with 91.6% selectivity

at 95.2% conversion. The by-product is formic acid. (J.P. 62,142,133, June 1987, Cf. *Chem. Abstr.*, 1988, 108, 58337).

Styrene oxide/glycol to phenylacetaldehyde

G. Paparatto and G. Gregorio have shown that H-ZSM-5 and zilicalite (and in some cases even silica gel) allow selective isomerization/dehydration of the title compounds. At 200°C , 96% yield at 99% conversion can be realised with styrene oxide as well as styrene glycol. (*Tetrahedron Lett.*, 1988, 29, No.12, 1471).

Ortho Chlorination of phenols with N-Chlorodialkylamines in the presence of silica

K. Smith et. al. have shown that phenol gives fairly high *ortho* to *para* ratio of monochloro compounds; the highest ratio was 15.8 with $\text{ClN}(\text{CH}_2\text{CH}_2\text{Cl})_2$ but even diisopropylamine chloramine gives a ratio of 5.0. In the case of *ortho* chloro-phenol *o*- to *p*-ratio of 4.7 was realised. (*Tetrahedron Lett.*, 1988, No. 11, 1319).

Intensification of multiphase reactions through a second microphase

Sharma and co-workers have devised a novel strategy of intensifying a variety of gas-liquid and solid-liquid reactions through the use of a second liquid phase which is emulsified with the phase in which the reaction occurs. The prime requirement for the second liquid phase is that it should exhibit much higher solubility for the solute. Intensification in the specific rates of absorption of propylene and butenes in aqueous sulphuric acid solutions, with chlorobenzene as the microphase, has been experimentally observed and the intensification factors have been as high as 25. The alkaline hydrolysis of solid *p*-substituted phenyl benzoate esters has also been subjected to intensification. A comprehensive model has been proposed by Mehra. (*Chem. Eng. Sci.*, 1988, 43, 913; 899).

Para chlorobenzene derivatives

It has been claimed that the liquid phase chlorination of benzene or its derivatives, in the presence of Faujasite type zeolites and S compounds (e.g. S_2Cl_2), at 100°C , gives predominantly paradichlorobenzene with 86.5% selectivity and 64.8% conversion. (Jap. Pat. 62,153,234 of July 1987, Cf. *Chem. Abstr.*, 1988, 106, 940205).

y 24, 1988

C ORDER ON JUTE BAGS

HDPE units facing closure

With the Supreme Court vacating the stay orders granted by different High Courts on the operation of the jute packaging mandatory order, the HDPE units are facing the gloomy prospect of closing down their factories.

There are about 500 units manufacturing HDPE woven sacks of which 100 are in the small sector. Half of them had already downed their shutters during the last one year. The surviving units depended wholly on orders from cement units and with the Supreme Court now vacating the stay orders and giving 15 days' time to strictly enforce the mandatory order, they will be left with practically no orders from either the fertiliser industry or the cement units.

An estimated Rs. 250 crores has been put in the nascent HDPE industry by financing institutions during the last three years and not a single unit has paid any interest, let alone the principal amount. Just as in the case of fertiliser industry recently, the Textiles Ministry is likely to go in full steam in executing the mandatory order and will be eight to ten months for the statutory order of 70 per cent of cement being packed in jute bags to be completed. And in the meanwhile, there is no cause for the languishing HDPE units to run.

According to Mr. Ramesh Jain, President, All-India Flat Tape Manufacturers Association (AIFTMA), the SC order came as a bolt from the blue and has hit the last nail into the coffin of HDPE industry. Mr. Jain stated that it was surprising that the court has ordered that exemptions could be sought from the Union Government from the operation of the Jute Mandatory Order and the same shall be given within six weeks from the date of application.

Following similar orders from Andhra Pradesh High Court in September last, both the Fertiliser Association of India and the Cement Manufacturers Association and also a number of individual cement units sought exemptions under Section 16 of the Jute Packaging Material (compulsory use of packing commodities) Act 1987, but so far no exemption is granted. Under the circumstances Section 16 of the

Act was only an "eye wash" and the Supreme Court vacating the stays did not help the matters but directly hit the HDPE industry.

Moreover, implementation of the mandatory order in full steam is bound to receive high consumer resistance much to the detriment of the ailing fertiliser and cement industry in the country. Those cement companies with more than one manufacturing location made pleas for consideration as a "whole unit" but this was rejected and they were told that implementation of the jute packing order would be "unit-wise".

And it is possible for any amount of market distortion to take place as many mini-cement units operating locally now face the prospect of bigger units dumping cement packed in HDPE bags (balance 30 per cent).

Mr. Jain reiterated that compulsory packing in jute bags would entail a national loss of Rs. 240 crores as it has been already established that seepage losses in cement worked out to 5 per cent of the total production of 40 million tonnes. This came to two million tonnes.

In addition, cement in jute bags is a positive health hazard to the human carrier and also a pollutant. It is these considerations that made the cement industry representatives plead for a free hand in packaging material of their choice.

A number of cement manufacturers have apprehended a very severe consumer resistance if the cement is compulsorily packed in jute bags. The industry is already beset with production problems on account of hefty power cuts and one more marketing problem will be on their list with jute bags packing order, the industry spokesman stated.

PLASTIC SACK UNITS SEEK EXCISE DUTY WAIVER

The All-India Flat Tape Manufacturers' Association (AIFTMA) has urged the government to exempt plastic sacks from excise duty since the textile ministry has already succeeded in its objective of protecting the jute industry through a series of legislative, executive and judicial orders.

The AIFTMA general secretary, Mr. Tikam Patni, told newsmen in New Delhi recently that the textile ministry was pursuing the cause of the jute industry "with vendetta and prejudice" against the plastic sack industry and it has managed, through the compulsory jute use act to choke all marketing outlets of plastic sacks.

He said before the jute use act, 85 per cent of the sacking market was reserved for the jute industry in any case. Now even in the balance 15 per cent of the market, comprising the packing needs of the cement and fertiliser industries, competition to jute bags from plastic sacks was not being tolerated.

FOREIGN INVESTMENT: TEAM LEAVING FOR JAPAN, US

Prospects of increasing the flow of direct foreign investment as well as technological collaborations will be explored during the forthcoming visit of a high-level official delegation headed by the industry minister J. Vengala Rao to the US and Japan.

The team which leaves shortly will examine possibilities for stepping up collaboration with reputed US companies in the field of petrochemicals, pharmaceuticals and chemicals.

The secretary, chemicals and petrochemicals Mr. H. K. Khan will accompany Mr. Vengala Rao on this leg of the tour. A much larger delegation will, however, meet the industry minister in Tokyo, evidently in keeping with Prime Minister Rajiv Gandhi's recent initiative for closer industrial co-operation with Japan.

Apart from the secretary, industrial development, Mrs. Otima Bordia, this group will include chief executives of Andrew Yule and Maruti Udyog as well as representatives of Ficci and Assocham.

The delegation, it is reliably learnt, will hold a series of discussions as a follow-up to issues raised during the earlier visit of Mr. Gandhi to Japan. These will include the difficulties being faced by Japanese companies in implementing the phased manufacturing programme (PMP) laid down by the industry ministry for joint ventures. The procedural problems faced in stepping up the flow of direct foreign investment will also be examined.

HCL asked to draft plan

The government has asked the Hindustan Copper Limited (HCL) to carry out a detailed exercise on the phasing out of the uneconomic mines and diversion of workforce to new mines.

HCL has identified two new areas to be opened up — one is at Banwas under the Khetri copper complex and the other at Chapri Sidheshwar under the Indian Copper complex. Mine development at these two places is going apace to augment production at reduced cost.

This is one of the steps being taken by the government to increase indigenous production of copper in the immediate future.

The other steps include a Rs. 3.51-crore integrated study of the Singhbhum copper belt in Bihar. The study, which is expected to be completed in August 1989, aims at obtaining detailed project reports on deposits already explored in the area and to formulate a long-term strategy for exploiting the potential of the belt.

HCL proposes to take up detailed exploration of copper reserves in the area around the Malanjkhand copper project in Madhya Pradesh for establishing the reserves and preparing a feasibility report towards taking a decision about setting up a complex for mining, smelting and refining copper. The proposal is under consideration of the Public Investment Board.

The government has sanctioned schemes for debottlenecking and modernisation of the smelters and refineries at the Khetri copper complex and the Indian copper complex at a cost of Rs. 50.85 crores. The implementation of these schemes have already begun and are expected to be completed by early 1990.

On completion of the modernisation schemes, the smelters and refineries at the two complexes are expected to function to their full capacities of 31,000 tonnes and 16,500 tonnes per annum and are also expected to produce better quality of copper and effect better by-product recovery.

BCL has commenced installation of a continuous cast copper rod plant with a capacity of 60,000 tonnes per annum. This plant is scheduled to be operational by 1989-end.

The company has decided to set up facilities to produce 30 tonnes per annum of OFE copper at Hyderabad using vacuum induction melting technology developed by the defence metallurgical research laboratory. 1988-89, five tonnes of OFE copper products are expected to be marketed to the electronic industry and this is likely to increase to 30 tonnes in 1990-91.

The other long-term measures include stepping up research and development efforts for introduction of technological improvements for higher recovery and performance by modification of the plants.

With the expansion of smelters and refineries at the Indian copper complex and the Khetri copper complex as well as with the setting up of CCC rod plant at Talaja, HCL expects to produce 97,000 tonnes of copper annually from 1994-95 onwards, thus meeting 5 per cent of the total demand in the country.

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Fertiliser units seek greener pastures

The Indian fertiliser industry is entering a new phase of transition. The winds of change sweeping the industry may result in the emergence with altogether new profile in a couple of years.

Most of the major fertiliser companies are diversifying in areas totally unrelated to their current fields of activity. For example, the Rashtriya Chemicals and Fertilisers Limited (RCF) is contemplating to enter the electronics field and plans to produce TV picture tubes. Ifco and Kribhco are reported to be interested in aromatic plants. The Southern Petrochemical Industries Corporation (Spic) is entering the shipping business.

The Gujarat State Fertiliser Corporation Limited (GSFC), a highly successful joint sector fertiliser company of Gujarat, is embarking on a massive Rs. 1,000-crore diversification programme and plans to reduce dependence on fertiliser to 40 per cent in the next few years. The Gujarat Narmada Valley Fertiliser Corporation Limited (GNFC), promoted by GSFC, has already entered the automobile sector and is producing Narmada scooters.

Industry sources point out that diversification per se is a healthy sign when an organisation is flush with money. But it is a different story so far as the fertiliser companies are concerned since these are not floating in cash. The profitability of the industry was a mere Rs. 29 crores in 1986-87 on an investment of over Rs. 8,000 crores.

Moreover, the sources say, diversification is always in fields where demand exists or is expected to arise. Fertiliser units need not diversify since the demand for fertilisers itself by the turn of the century is placed around 20 million tonnes of nutrients and the production for the current year is expected to be around 8.7 million tonnes of nutrients. With this expected jump in demand, normally the fertiliser units should be trying to increase their capacities and vying with each other to set up more units.

It is, however, apparent that the industry is shaken by the drought of the last four seasons which has left it saddled with an unsold stock of nearly 2.7 million tonnes of fertilisers worth over Rs. 1,000 crores.

Combined with this are some of the steps taken by the government from time to time which unwittingly aggravated the wounds inflicted by bad weather. First heavy imports were made and the tender system was introduced for imported fertilisers. This was followed by drastic changes in the Essential Commodities Act (ECA) allocation.

The adjustments in the retention price scheme for the period commencing from April 85 were delayed and announced only at the end of March 1987. To top it all, the government neither confirmed nor denied the acceptance of B.B. Singh's report which suggested some drastic changes in basic parameters such as increasing the norms of capacity utilisation or reducing the rate of return. This created an atmosphere of uncertainty. The industry, in the mean time, suffered severe liquidity problems and indulged in heavy rebates.

The sources say that though many of the problems were solved in bits and pieces by the government, yet the talk of changing the retention price formula and the government's desire to reduce fertiliser subsidy keep emanating from time to time keeping the manufacturers disturbed.

These uncertainties helped the investing public keep away from the fertiliser units. This was evident from the public issue of Indo-Gulf Fertilisers which could be subscribed only to the extent of 60 per cent. The Caparo group of Swaraj Paul is also reported to have lost interest in putting up the Shahjahanpur plant fearing similar problems.

According to the sources, the worst sufferers are those already in the field. They are realising that doing business in fertilisers alone would not take them anywhere. The sources say that their survival now depends only on diversification.

GROUP SET UP TO FORMULATE 8TH PLAN FOR ENVIRONMENT

The Planning Commission has set up a 30-member steering group under the chairmanship of Dr. M. S. Swaminathan, eminent scientist and a former member of the Planning Commission, to formulate the Eighth Five Year

Plan (1990-95) for environment, forests and wastelands development.

The terms of reference of the steering group include recommendation of a policy framework for activities in the areas of environment, ecology, forestry, wildlife and wastelands development for the next plan taking into account the progress made in the implementation of the Seventh Plan programmes in the designated fields.

The group has also been asked to review and assess the actual progress and achievements/shortfalls of the Seventh Plan programmes in the designated fields.

The group has also been asked to review and assess the actual progress and achievements/shortfalls of the Seventh Plan vis-a-vis the targets, and to identify areas of high priority keeping in view of the plan objective relating to the socio-economic development of the country. The group is required to evolve a workable land and water use plan with a view to meet, on a sustainable basis, the need for food, fodder, fuel, water, energy and industry.

It has also been asked to suggest linkages with other programmes as also to give special attention to important but fragile eco-systems such as the Himalayas, islands, wetlands, and cold and hot deserts. The steering group will assess and recommend the financial requirements of these sectors ensuring the concept of zero based budgeting for a five-year plan period.

Prof. M.G.K. Menon, member, Planning Commission, in charge of environment and forestry sectors, will be fully associated with the work of the steering group and will attend the meetings.

SHORTFALL IN ALUMINIUM OUTPUT

Public and private sector plants produced 25,064 tonnes of aluminium metal during April, 1988, against a target of 29,000 tonnes.

Of this, the public sector Bharat Aluminium Company Ltd. produced 6,809 tonnes, Indian Aluminium Company Ltd. 2,664 tonnes and Hindustan Aluminium Company Ltd. 10,162 tonnes, an official release said on May 16.

During the month, National Aluminium Company (NALCO) transported 39,707 tonnes of bauxite to alumina plants and produced 31,600 tonnes of alumina.

GLUT IN FERTILISERS:

Discount war in offing

Though the manufacturers of fertilisers have been allowed to offer a discount of 7.5 per cent to the farmers on the maximum consumer price of urea (a nitrogenous fertiliser) after a high level meeting between the government and the industry, it is being noticed that the nutrient is sold in many parts of the country at a price lower than the officially permitted level. The problem is particularly manifest in Uttar Pradesh.

While the statutory maximum consumer price of urea remains at Rs. 2350 a tonne (or Rs. 117.50 a 50 kg bag), the farmers, according to the government order should be charged Rs. 2174 a tonne (or Rs. 108.70 a 50 kg bag), after a discount of 7.5 per cent plus local taxes. The government is compensating the manufacturers for discount on actual sales. One finds in UP rural areas that a 50 kg urea bag is sold at least Rs. five lower than the officially discounted price.

The situation in UP as far as marketing of fertiliser goes was much worse in the last kharif season when a 50 kg urea bag was sold at about Rs. 85. The basic reason for the fertiliser companies giving more than the stipulated discount is due to excess inventory. As on March 1, 1988, the country was nursing stocks of 3.29 million tonnes of fertilisers (NPK), including 2.6 million tonnes of nitrogen.

The fertiliser companies which must maintain production at a high level for technical reasons as also to get the 12 per cent post tax return on net worth (equity plus reserves) which is linked to 80 per cent capacity utilisation, can, in the present situation partly take care of the cash flow problem by offering a higher discount to the consumers. As is known a fertiliser unit can only sell that amount for which it receives allocation from the government. In the last couple of fertiliser seasons allocation for urea has amounted to around 60 per cent of production.

It is only to be expected that with this kind of allocation, the fertiliser companies will be locked in an intense competition to sell their product at whatever price they manage to get. The pitch for the indigenous fertiliser industry has been queered primarily for three reasons. First, the consumption of fertilisers during the period 1984-85 to 1986-87 increased at a very slow rate from 82. lakh tonnes to 87.38 lakh tonnes, belying the official forecast for growth. Second, in the three years, since 1984-85, the country had imported 33.05 lakh tonnes of fertilisers, though the situation did not warrant so. Third, the government was too liberal in releasing the stocks of imported fertilisers.

The situation has somewhat improved with the government applying the brake on imports and holding back the release of imported fertilisers. While it has very rightly sanctioned inventory carrying costs to the units holding stocks of the imported material, the indigenous manufacturers are still being paid godown and interest costs though their stocks of fertilisers are much in excess of the norms fixed under the retention price scheme.

It was as early as in October 1987 that the government promised the industry reimbursement of the cost of inventory maintenance as was done in the case of imported fertilisers. In July 1987, the assurance on the issue was specific to the extent that the manufacturers were emboldened to reduce discounts. It is learnt that the government is once again actively considering the issue.

A study of fertiliser companies in the state, co-operative and private sectors for the period 1985-86 to 1986-87 shows that while their production had increased from 51.71 lakh tonnes to 64.40 lakh tonnes (a growth of 24.5 per cent), their profits had fallen from Rs. 90.69 crores to Rs. 24.08 crores. The sad thing about the fertiliser industry is that while its performance in terms of production is quite encouraging, it is not able to get the assured 12 per cent post tax return or 24 per cent pre tax return because of under-recovery on various cost accounts and the difficult marketing condition forcing discount sale.

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EQUIPMENT FOR FERTILISER PROJECTS:

Three Co.s seek imports

Three large fertiliser projects may go in for direct import or import through international competitive bidding (ICB) for procuring capital equipment to the detriment of the domestic capital goods industry, according to a report appearing in *The Economic Times*.

Aravali fertiliser project in Rajasthan, Nagarjuna-Kakinada fertiliser projects in Andhra Pradesh and the GSFC urea and ammonia project in Gujarat are understood to have approached the government for allowing them to import a part of their capital equipment directly and some other items of machinery through international competitive bidding.

The domestic capital goods sector fears that in either case, it is bound to suffer despite its proven technical capability and ability to compete.

The protection given to the domestic industry against direct imports is 15-per cent import tariff. Also, imports are allowed after an indigenous unavailability clearance is obtained. But it has been the experience of the domestic industry that despite the industry that despite the indigenous capability in specific equipment, project authorities have conveniently dodged the indigenous angle criteria and obtained import licences. They have succeeded in doing so by putting rigid technical specifications, delivery schedules and guarantee terms and then making out a case for imports on the basis that the domestic suppliers cannot meet those specific requirements of the projects.

For instance in the case where the domestic manufacturer has supplied a similar equipment or an equipment slightly different in specifications than from those required by the project authorities, his claim to supply the equipment has been ignored on the ground that he has not manufactured that particular equipment in the past.

Likewise, project authorities have at times rejected domestic offers because of a long delivery schedule and have gone in for imports which in practice have even taken longer.

The domestic industry feels that in the case of projects having foreign parties as turnkey consultants, the ten-

dency to resort to imports is more pronounced.

Whereas the consultants for the GSFC project are yet to be finalised, the Italian company Snamprogetti, is providing the consultancy services for both Aravali and Nagarjuna-Kakinada projects.

Direct imports would mean the project authorities can place their order on any foreign manufacturer of their choice without tendering. Though the formal procedure of getting indigenous availability clearance has to be gone through, the domestic industry fears that this would hardly provide any protection to it considering the import-bias of project authorities and their foreign consultants.

In the case of ICB, though global tenders are floated, the bid evaluation formula followed in fertiliser projects, according to the industry, is discriminatory and does not allow domestic suppliers to effectively compete with foreign firms. While the industry welcomes the practice of ICB, it has reservations about the evaluation formula.

An analysis made by the Confederation of Engineering Industry (CEI) shows that there are at least 40 items of fertiliser capital equipment, where the Indian companies have already proven their capability and these have been supplied to a number of major projects in the country. The projects include: HFCL Haldia, (Namrup and Durgapur, Neyveli Lignite Corporation, NFL (Guna and Nangal), Ifco (Aonla and Phulpur), GNFC, IEL, Kribhco (Hazira) Indo-Gulf (Jagdishpur), Spic, SriRam Fertilisers, RCF, Fact, and others.

The items supplied include: Urea reactor, urea hydrolyzer, carbamate separator, CO2 compressor delivery drum, inter stage separators, carbamate condenser, hydrolyzer preheater, ammonia preheater, interstage coolers, all heat exchangers/condensers, waste heat boilers, naphtha preheater, steam drum, gas exchanger, ammonia synthesis converter, ammonia separator, re-boiler/condenser and host of other equipment.

The domestic capital goods industry has also demonstrated its global

competitiveness for a variety of capital equipment in the World Bank-aided projects, the local manufacturers have power plants and atomic energy projects. Evaluated on the basis of the World Bank formula, the domestic suppliers emerge clear winners. Even in the case of ICB, as evaluated by ONGC, power plants and atomic energy projects, the local manufacturers have a distinct edge, according to CEI.

In the case of all evaluation procedures, including the formula followed for fertiliser projects, the ex-works costs of Indian equipment compare favourably with the landed cost of imported equipment even without considering the import duty factor.

The World Bank formula gives the Indian bidder a price preference of 15 per cent and the deemed experts benefits (7.5 per cent of CCS and three per cent as effect of packing credit). Assuming 50 per cent import content in the Indian equipment, the final price advantage here works out at 34.6 per cent.

In the case of ONGC, power plants and atomic energy projects, the advantage to domestic bidders works out to 13.83 per cent, 21.18 per cent and 33.5 per cent for nil import duty, 25 per cent duty and 85 per cent duty, respectively. Though an excise duty component of 15 per cent is added on to the Indian equipment prices, this is more than offset by the 25 per cent price preference given to local suppliers.

ICB, as evaluated for fertiliser projects, however, stands out in total contrast. Here, an excise duty of 15.75 per cent and sales tax of four per cent are added on to the domestic equipment price as a result, the handicap thrust on indigenous capital goods industry could be as much as 6.13 per cent, 8.76 per cent, 12.72 per cent and 16.05 per cent depending on the degree of import content in the Indian equipment.

Admittedly, there is an import duty of 15 per cent on the foreign equipment, but the same rate also applies to the imported component raw materials that go into the domestic manufacture of equipment. The import content in the Indian equipment could be anywhere between 40 per cent and 60 per cent.

(Contd. on Col. 3, p. 64)

RSP fertiliser unit revamp mooted

The SAIL management is examining the recommendations of Dr. S. K. Mukherjee, fertiliser expert and consultant, for strengthening the operations of Rourkela Steel Plant's giant fertiliser unit.

A considerably low level of production and resultant low returns in the past few years, when availability of power and coke oven gas fell far short of requirements, weighed with the SAIL management in instituting an expert study, primarily with the objective of deciding whether it is worthwhile to continue fertiliser production.

Dr. Mukherjee's study has established the scope for making the RSP fertiliser unit viable with certain additions, modifications and replacements and simultaneous upgradation of process technology. Tentative estimates place the investment on the project at around Rs. 100 crores.

Among the important recommendations of Dr. Mukherjee are: discontinuance of coke oven gas usage, con-

version of naphtha reforming plant (NRP) I for production of methanol, addition of new equipment like PSA to NRPI if methanol production is not to be undertaken on market consideration, setting up of one more NRP, pressure absorption system, fog nitric acid plant, setting up of a fuel oil fired boiler unit and replacement of original four lines in the CAN plant by a large capacity single unit.

The study has observed that despite the unit being more than 25 years old, its machinery and equipment are generally in good shape and therefore, upgradation of process technology with desirable additions, modifications and replacements should make it a paying proposition.

Taking these recommendations into account and keeping in view that the power situation has already improved with the implementation of the captive power plant II project (60MWx2), the SAIL management has come to the conclusion that the fertiliser unit should continue to be an operating

unit of the RSP complex. Plans also afoot to revamp thoroughly RSP captive powered plant I. With the availability from the Orissa state electricity board system, the long-term prospects for availability of power, therefore, appear to be quite satisfactory.

According to Mr. Monish Chandra Tarafdar, managing director of RSP, the revival strategy for the fertiliser unit is likely to be worked out in the course of the next three-four months. Thereafter, it will be considered by the SAIL board and posed to the Union government for the investment decision.

NEW SUPERCONDUCTOR FROM CPRI

The Central Power Research Institute in Bangalore has developed a ceramic material superconductor at a temperature of 93 degrees K.

The latest issue of a CPRI newsletter said the superconducting material called "1:2:3 compound" or "YBaCuO", was prepared with starting materials yttrium oxide, barium carbonate and copper oxide by the materials technology division.

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BOX NO 2210

C/o. CHEMICAL WEEKLY

306, Shri Hanuman Industrial Estate,
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Capital goods import made easier

The commerce ministry has notified a simplified procedure for the import of capital goods against a loan of \$ 100 million given to the Industrial Development Bank of India by the Asian Development Bank (ADB) for lending to state financial corporations for the purchase of plant and equipment.

According to a public notice issued by the chief controller of imports and exports, ADB has made available to SFCs, credit in various currencies, equivalent to US \$ 100 million, the proceeds of which will be utilised by IDBI for refinancing loans disbursed by the state financial corporations (SFCs) to industrial undertakings in the medium and small-scale sectors.

The proceeds of this ADB loan are available for refinancing loans granted by SFCs to such industrial units in the small and medium sectors which are eligible for assistance under the SFCs Act.

The last date for the commitment of the loan is February 24, 1991, and the last date for utilising the loan is February 24, 1992.

Loans may be granted by SFCs to these industrial units for setting up new projects as well as for expansion, diversification of existing units, for financing import of capital goods, technical know-how and services.

The maximum limit of loan is Rs 10 lakhs for units as provided under the SFCs Act. Industrial concerns having paid-up capital and free reserves exceeding Rs three crores are not eligible for assistance from SFCs.

Irrespective of the size of the borrowing unit value of import licence, applications for the import of capital goods against this credit will be considered by the capital goods ad hoc committee.

Industrial units desirous of making use of the facility under this credit will apply to the state financial corporation concerned for sanction of assistance and simultaneously apply to the chief controller of imports and exports for an import licence.

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issued a letter of intent for manufacturing a particular item, he is eligible for the capital goods import licence. It will be issued to him only after the industrial licence is issued to the applicant in lieu of the letter of intent held by him.

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Simultaneously, the applicant should apply to SFC for a loan for his project including loan for the import of capital goods. The essentiality of an imported plant and equipment should be certified by the concerned SFC, the public notice has explained.

Orders should be placed on CIF or C and F basis, it is stated.

IFCI CONSULTANCY SCHEME TO CONSERVE ENERGY

The Industrial Finance Corporation of India (IFCI) has proposed to introduce a scheme of subsidy for consultancy on use of non-conventional sources of energy and energy conservation measures, effective from July, 1988. The scheme would provide subsidised consultancy services to the beneficiaries in the rural, tiny and small-scale sector through the institutionally sponsored technical consultancy organisations (TCOs) operating all over the country.

The rising cost of conventional sources of energy and the fast dwindling reserves of fossil fuels have made it imperative for the main consumers of energy to formulate appropriate schemes aiming at, not only cutting down the consumption level of energy in the form it is currently available but also to produce and make wider application of the alternate and renewable sources of energy.

IFCI's scheme would help in fulfilling a vital gap in the area by making available the consultancy services through TCOs to eligible beneficiaries at a subsidised fee, the extent of subsidy being 50 per cent of the fees or Rs. 5,000 whichever is less. Where a TCO is involved not only in the formulation of energy conservation plan or making application of non-conventional energy sources, but is also involved with the actual implementation

amount of subsidy can go up to 75 per cent of the TCOs fees or Rs. 7,500 whichever is less.

Any existing unit in the village and small industries (VSI) sector can claim subsidy under the scheme.

It is expected that the scheme would not only go a long way in creating an awareness and culture for consultancy in areas leading to better energy management, conservation, and/or maximisation of use of energy, but also result in the application of non-conventional sources of energy in the VSI sector, as well.

IDBI SCHEME FOR SMALL UNITS

Details of a new refinance scheme introduced by the Industrial Development Bank of India (IDBI) were placed before both houses of Parliament by the minister of state for finance, Mr. Eduardo Falcoiro. The scheme seeks to provide through a single window finance for the acquisition of fixed assets and working capital to tiny and small-scale units. A reference to this scheme was made by the finance minister in his budget proposals for 1988-89.

At present, finance for the acquisition of fixed assets by small-scale units is obtained from the banking sector and from state-level corporations (SIDCs/SFCs) often meet with difficulties and delays in working capital finance. To overcome this problem IDBI has introduced a new refinance scheme to enable SFCs and twin-function SIDCs to provide through single window, both term loan for fixed asset and working capital to new tiny and small-scale units whose project cost does not exceed Rs. 5 lakhs. The facility under the scheme, which has been finalised in consultation with the Reserve Bank of India, is intended to enable SSI units to start commercial production expeditiously.

Besides providing term loans for fixed assets, SFCs/SIDCs will also simultaneously provide working capital loans up to Rs. 2.5 lakhs. Such loans repayable within a period not exceeding ten years, including an initial moratorium up to three years, will carry interest at the rate of 14 per cent if the working capital loan is up to Rs. 2 lakhs and 15.5 per cent if the loan exceeds this sum but is less than Rs. 2.5 lakhs with the corresponding interest on refinance to SFCs/SIDCs being 9.5 per cent and 11 per cent respectively.

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IFCI CONSULTANCY SCHEME TO CONSERVE ENERGY

The Industrial Finance Corporation of India (IFCI) has proposed to introduce a scheme of subsidy for consultancy on use of non-conventional sources of energy and energy conservation measures, effective from July, 1988. The scheme would provide subsidised consultancy services to the beneficiaries in the rural, tiny and small-scale sector through the institutionally sponsored technical consultancy organisations (TCOs) operating all over the country.

The rising cost of conventional sources of energy and the fast dwindling reserves of fossil fuels have made it imperative for the main consumers of energy to formulate appropriate schemes aiming at, not only cutting down the consumption level of energy in the form it is currently available but also to produce and make wider application of the alternate and renewable sources of energy.

IFCI's scheme would help in fulfilling a vital gap in the area by making available the consultancy services through TCOs to eligible beneficiaries at a subsidised fee, the extent of subsidy being 50 per cent of the fees or Rs. 5,000 whichever is less. Where a TCO is involved not only in the formulation of energy conservation plan or making application of non-conventional energy sources, but is also involved with the actual implementation of the scheme suggested by it, the

amount of subsidy can go up to 75 per cent of the TCOs fees or Rs. 7,500 whichever is less.

Any existing unit in the village and small industries (VSI) sector can claim subsidy under the scheme.

It is expected that the scheme would not only go a long way in creating an awareness and culture for consultancy in areas leading to better energy management, conservation, and/or maximisation of use of energy, but also result in the application of non-conventional sources of energy in the VSI sector, as well.

IDBI SCHEME FOR SMALL UNITS

Details of a new refinance scheme introduced by the Industrial Development Bank of India (IDBI) were placed before both houses of Parliament by the minister of state for finance, Mr. Eduardo Falcão. The scheme seeks to provide through a single window finance for the acquisition of fixed assets and working capital to tiny and small-scale units. A reference to this scheme was made by the finance minister in his budget proposals for 1988-89.

At present, finance for the acquisition of fixed assets by small-scale units is obtained from the banking sector and from state-level corporation (SIDCs/SFCs) often meet with difficulties and delays in working capital finance. To overcome this problem IDBI has introduced a new refinance scheme to enable SFCs and twin-function SIDCs to provide through single window, both term loan for fixed asset and working capital to new tiny and small-scale units whose project cost does not exceed Rs. 5 lakhs. The facility under the scheme, which has been finalised in consultation with the Reserve Bank of India, is intended to enable SSI units to start commercial production expeditiously.

Besides providing term loans for fixed assets, SFCs/SIDCs will also simultaneously provide working capital loans up to Rs. 2.5 lakhs. Such loans repayable within a period not exceeding ten years, including an initial moratorium up to three years, will carry interest at the rate of 14 per cent if the working capital loan is up to Rs. 2 lakhs and 15.5 per cent if the loan exceeds this sum but is less than Rs. 2.5 lakhs with the corresponding interest on refinance to SFCs/SIDCs being 9.5 per cent and 11 per cent respectively.

RS. 300-CR LPG UNIT AT BIJAIPUR:

GAIL seeks PIB approval

The Gas authority of India Ltd. (Gail) is now approaching the Public Investment Bureau (PIB) for approval to set up an LPG extraction plant using HBJ gas at Bijapur with an investment of about Rs. 300 crores.

In addition, it is planning to put up a plant for extracting propane which will be processed for making petrochemicals, it is learnt. This will cost about Rs. 180 crores.

According to information available in New Delhi, Gail envisages a production of 4.6 lakh tonnes of LPG per annum from the LPG extraction plant. The gas requirement for this would come to about 15 million cubic meters a day.

The first stage of the LPG extraction project is expected to cost about Rs. 200 crores while the second may come to Rs. 100 crores. The expectations are that the project can be put into operation within three years.

In fact, the available information is that the plant would be put up by Engineers India Ltd. (EIL) for Gail.

As regards the propane extraction plant, it is learnt that the authorities are examining the possibility of setting up a joint sector company for this purpose. The venture, at current prices, is expected to cost Rs. 180 crores.

Meanwhile, work on the HBJ pipeline is progressing well and indications are that it will be completed in all respects by July 1989. The pipeline section from Hazira to Bijapur, and Bijapur to Aonla has already been commissioned and gas is being supplied to the fertiliser plants at the National Fertilisers Ltd. (NFL) and IFFCO at Guna, MP, and Aonla, UP, respectively.

The cross country pipeline is expected to play a major role in the overall development of the natural gas industry. It is expected to provide natural gas as feedstock to six fertiliser plants and three power plants, going by the original plants.

The sites of the fertiliser plants are Bijapur (Madhya Pradesh), Sawai Ma-

dhapur (Rajasthan), Jagdishpur, Shahjahanpur, Aonla and Babrala (all UP). In addition gas will be supplied to two LPG plants at Bijapur and Auriya.

Recently, Gail was allowed to take the HBJ pipeline to Delhi and its neighbouring areas by building a spur line from Babrala.

CIL ASSURES BETTER QUALITY SUPPLIES

Coal India will try to give better linkage to the consumers of superior quality coal, the Coal India Chairman, Mr. G. L. Tandon, said in Ahmedabad on May 17th.

Talking to newsmen he claimed that it was difficult to supply good quality of coal to all consumers because only 14 per cent of the coal produced in the country belonged to this category.

Referring to another serious complaint of shortweight of coal supplied to the consumer, he said that it was due to pilferage and that Coal India was not responsible for it.

He said that as many as 157 points were installed with weigh-bridges and the remaining loading points would be covered during this financial year.

Earlier, in a meeting with coal consumers, Dr. Biharilal Kaniyalal, President, Ahmedabad Textile Mills Association (ATMA), pointed out that although during the last year the supply of priority coal has gradually increased the full quantities have, however, not always been received. The proportion generally has been 50 to 70 per cent of the total requirements. Consequently mills are obliged to purchase coal at times from the open market at a price which is higher by 25 to 50 per cent.

The ATMA President suggested that immediate action should be taken to instal electronic weigh-bridges on all loading points and keep them in good order. There is room for improvement in the loading of wagons with the correct weight.

The actual requirements of coal in terms of quantity and quality should be ascertained by CIL and the quota of consumers should be linked with the collieries or the subsidiaries in a manner so that the requirements of consumers is satisfied and are enabled to draw their supplies from WCL or SECL accordingly.

An account of highly irregular and concentrated movement of coal, particularly in the last 10 days has given rise to apprehensions that the quota may lapse. To obviate difficulties of industries in this regard the Gujarat chamber suggested that the supply of coal should be evenly spread over all weeks or if the consumer desires the requisite quantity may be supplied once at a time in a month so as to facilitate the supervision.

BANGALORE VARSITY TO WORK ON SUPERCONDUCTIVITY

The University Grants Commission (Uac), has asked Bangalore University to take up research on superconductivity.

Disclosing this to newsmen university vice chancellor D.M. Nanjundappa said Rs. Three lakhs had been initially granted for the purpose. The physics department would co-ordinate the research work in which chemistry and engineering facilities would also be involved.

(Contd. from p. 61)

The domestic capital goods industry, therefore, fears that the move by the three fertiliser projects to go in for ICB would result in local suppliers being outpriced despite their clear advantages.

It has argued that quite often, for want of adequate information on indigenous capability, several items of capital goods continue to be imported. The indigenous capacities for manufacture of identical or similar equipment remain idle and underutilised. These capacities have been set up at considerable costs. Most of the units have running collaborations with access to latest technology, for which considerable amount of foreign exchange is remitted every year.

ONGC's crude output up

During the period 1981-82 to 1987-88, Oil and Natural Gas Commission's crude production in the eastern region covering Assam and the entire North-East (except Arunachal Pradesh which is under Oil India Limited, and Tripura which is under ONGC's central region) increased from 1.87 million tonnes. During the same period, Oil India's production in the region dropped from 2.9 million tonnes to 2.45 million tonnes.

ONGC's gas production during the period jumped from 0.88 million cubic metres to 1.63 million cubic metres.

ONGC sources in Hazira attribute the increased production to several factors such as the discovery of new fields following the stepping up of drilling activities in the region and the introduction of new technology. In addition to Lakwa, Geleki, Lakhmani and Rudrasagar, which are old fields, eight new fields have been discovered during the past three years. These are Borholla, Champang, Namti, Amguri, Charali, Changmaigaon, Demulgaon and Kaurgaon. Also, drilling has been stepped up wherever significant discoveries have been made. As against 13 rigs at the beginning of the Sixth Plan, there are now 37 rigs operating in the region. Several innovations like dragging the rig, clustered drilling and modifications have resulted in reducing the cost of drilling operations.

The crude production target (cumulatively) at the end of the Seventh Plan has been set at 14.3 million tonnes. Till now, there has been a marginal shortfall from the target — 7.3 million tonnes (cumulative) of actual production against the target of 7.9 million tonnes (cumulative). The targets for the first three years of the Seventh Plan were as follows: 1985-86: 2.5 million tonnes, 1986-87: 2.6 million tonnes, 1987-88: 2.8 million tonnes.

The corresponding production figures for these years were: 1985-86: 2.3 million tonnes, 1986-87: 2.67 million tonnes, 1987-88: 2.74 million tonnes.

The targets for 1988-89 and 1989-90 have been set at 3.1 million tonnes and 3.3 million tonnes, respectively. ONGC sources, however, indicate that the success of achieving the targets will depend greatly on the frequency at which bandhs are called, agitations

staged and barricades put up by AASU functionaries in areas where ONGC is operating in Assam. In 1987-88, ONGC's normal functioning in the state was severely affected by agitations and demonstrations by AASU functionaries.

In 1987-88, ONGC's plan expenditure in north-east (eastern region in ONGC's parlance) amounted to Rs. 218 crores and non-plan expenditure to Rs. 256 crores. The corresponding figures for 1988-89 are estimated at Rs. 244 crores and Rs. 300 crores, respectively. About Rs. 20 crores of the additional Rs. 44 crores of non-plan expenditure estimated for the current year will be on account of the increase in statutory charges to be followed from the rise in production. In 1986-87, the region's contribution to ONGC's total profits was to the tune of Rs. 192 crores. The figure for 1987-88, though not finalised as yet, is estimated to be over Rs. 200 crores.

BILL INTRODUCED TO PREVENT WATER POLLUTION

A Bill was introduced in the Lok Sabha on May 12, providing for stricter penal provisions for effectively controlling and preventing water pollution.

The Water (prevention and control of pollution) Amendment Bill of 1988, introduced by the Minister of State for Environment and Forests, Mr. Z. R. Ansari, seeks to elicit public co-operation. It proposes to enable any person to complain to the courts regarding violations of the provisions of the Act after giving notice of 60 days to the concerned board or the officer authorised on his behalf.

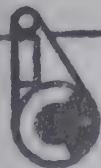
It proposes to empower the boards to give directions to any person to direct closure or regulate an offending industry and stop supply of water and electricity. It is also proposed to make obligatory on the part of a person to obtain consent of the relevant board for setting up and operation of an industry if it is likely to cause water pollution.



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ONGC drilling holiday in Andamans

A "drilling holiday" has been declared as part of the Oil and Natural Gas Commission's ongoing review of its exploratory operations in the Andamans.

The drilling activities were actually suspended in the Andaman offshore basin sometime in September-October last year, following a decision to review the progress there.

But, more recently, it has been decided to reassess and reinterpret the data gathered in the earlier exploratory operations there. Now, a "drilling holiday" has been declared, pending the results of the reassessment of the data.

It is not immediately clear as to how long this de novo examination of the data will take and whether and when the "holiday" will be called off. The data gathered earlier in the Andamans region is understood to be under scrutiny both at ONGC headquarters and at the organisation's southern regional centre in Madras.

Knowledgeable sources do not rule out the possibility of a resumption of the exploratory drilling in the Andamans, though there are no reliable clues at present as to the likely outcome of the ongoing reinterpretation of the data, undertaken with the help of certain advanced techniques of data processing.

It may be recalled that sometime before the exploratory drilling was suspended in the Andaman offshore region, ONGC was also thinking in terms of procuring "helirigs" for use there.

"Helirig" is but a rig specially fabricated. The main feature is that the various parts of the rig can be easily dismantled and later transported by a helicopter from one location to another. The idea is to quicken the pace of exploration in places such as the Andamans where the operational logistics require such facilities.

Though there is no authoritative word on the fate of this proposal to use "helirigs" in the Andamans offshore basin, it is clear that a decision on this can only follow a decision on whether and when the exploration itself should be resumed.

ONGC PLAN TO IMPLEMENT 9 EOR PROJECTS

The Oil and Natural Gas Commission (ONGC) will implement nine enhanced oil recovery (EOR) pilot projects during the Seventh Plan period as part of its long-term strategic planning.

ONGC sources in Calcutta, said three such projects had already been put into operation. They were polymer flood, caustic flood and Jhalor polymer flood projects, all in Ahmedabad.

The remaining EOR pilot projects, namely micellar polymer for the commission's Ankleshwar field, combustion and steam flood projects for Balol and Lanwa fields (Mehsana), carbon dioxide flood for Kalol field and LPG injection at Geleki field (Assam) would be executed shortly.

The sources said all the EOR pilots would go on stream before the plan period came to an end. Their evaluation would be carried out in the early part of 1990s.

As per ONGC's estimate, the implementation of EOR projects for Balol and Lanwa fields alone would jack up recoverable reserves by about 25 per cent resulting in additional revenue to the tune of Rs. 1700 crores based on the present market price of oil.

In case of enhanced oil recovery, the already known reserves of oil which cannot be produced by conventional methods are converted in to produceable reserves.

M'LORE REFINERY TO BE READY BY 1992

The final notification for the acquisition of land for the Mangalore oil refinery has been issued, minister for industries and power J.H. Patel told the assembly in Bangalore on May 12. He said that the extent of land being procured for the purpose was 1669 acres and 75 cents, in a written reply.

As per the implementation schedule drawn up by the promoters of the refinery the Plan is expected to be ready for commissioning by 1992. The total cost of the project as per present estimates is Rs. 1,200 crores.

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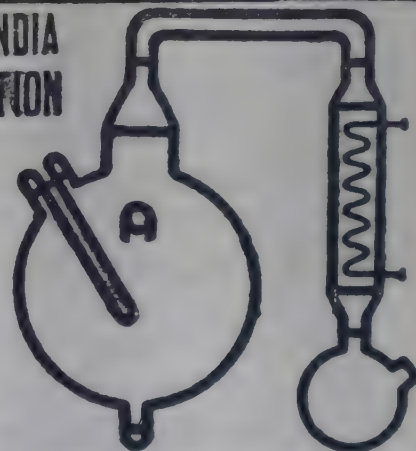
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EXPLOITATION OF NEW STRUCTURES:

ONGC launches novel scheme

A novel scheme termed "Floating early production system" has been launched by the Oil and Natural Gas Commission for early exploitation of newly discovered structures in the western offshore.

The floating system is said to have several advantages. It is not only a more efficient way of collection of reservoir data at a very early stage but it also reduces the time taken to formulate the final development plan.

The commission has studied the feasibility of having sustained trial production and has also identified the productive way of exploiting these structures by installing suitable floating early production system. It has been proved, say the ONGC sources, that the system permits long term testing and involves low capital investment.

But the most convenient aspect of the system is that it can be used as an extended facility or can become a permanent installation. It can also be relocated and thus help in serving both immediate and future needs.

The floating early production system at D-18 structure, located 40 kms

south west of Bombay High involves a semi-submersible based production facility and will have three basic components, namely, production source, processing facility and storage and transportation. Recent testing has indicated an oil production rate of 3,000 barrels per day and the estimated reserves of the structures are projected to be nearly 24 million tonnes.

The source of production, the ONGC sources said, would be two satellite wells completed at sub-sea. The average depth of the wells is likely to be 3500 metres. The design capacity has been created for processing 2000 barrels of crude per day on board the semi-submersible.

In addition to this, the floating process facility will have all utilities and living accommodation required to run and maintain the system. The crude oil produced sub-sea would be pumped to the tanker moored to a single buoy mooring system (SBM) located nearby. The transportation of crude would take place by transferring the stored crude to another vessel.

The average production after final completion would be approximately 5000 barrels of oil per day. ONGC proposes to charter hire the floating production for a period of 2 years involving an amount of Rs. 33.80 crores.

NEW RECORD IN WELL DRILLING

Oil companies are to be invited to join a project to drill a well with a horizontal reach of upto 9.6 kilometres — approximately double the existing world record.

Subject to UK Department of Energy approval and sufficient industry support being obtained, the proposed well will be drilled in the UK central North Sea, although the precise location has yet to be finalised. Drilling operations are planned to begin in early 1989, using a specially modified jack-up rig, and the project is expected to continue through most of the year.

The Extended Reach Drilling (ERD) project proposed by the British arm of the Conoco oil company will require an investment in the region of £22 million in engineering studies and operational costs, making it one of the largest research projects ever undertaken by the offshore oil and gas industry.

ERD — long reach, high angle drilling technology — has many applications in the North Sea and other oil producing areas of the world. Its development will considerably improve the economic viability of future fields by reducing the number of platforms needed to drain a reservoir or to reach outlying satellite structures. Technical advances associated with the ERD project will also lead to greater efficiency in drilling wells within the current range of horizontal reach.

The most extended reach well to date was drilled by Esso Australia in the Bass Straits, to a lateral displacement of 4,597 metres at a true vertical depth of 2,430 metres and an angle of between 69 and 72 degrees. The new well now planned will have a lateral displacement of between 8,534 and 9,753 metres (approximately 9.6 km) at a true vertical depth of 3,352-3,657 metres and an inclination of 72 to 75 degrees.

"The ERD project is an opportunity for a very significant step forward in drilling technology", says Conoco (UK) Limited chairman Mr. John Ogren. The ability to drill at greater reach will enable the industry to develop reserves that would otherwise be uneconomic.

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Karnal refinery : work to start this year

Work on the six-million tonne grass-roots Karnal refinery is likely to begin this year.

A technical team from Indian Oil and Tata Chemicals, partners of the joint venture company, will soon visit the Soviet Union to finalise the import of Soviet equipment on rupee payment.

This was stated in the detailed project report on the Karnal refinery presented by Indian Oil chairman S. H. Khosla and TCI chairman Darbari Seth to minister of petroleum and natural gas Mr. Brahm Dutt in New Delhi on May 10.

According to the report, the project will cost Rs. 1400 crores at current prices.

The Karnal refinery will use state of the art technology wherever necessary, digital control systems are being considered or installation.

For maintaining ecological balance, and environmental protection 10,000 trees have already been planted on the periphery of the refinery site, an Indian Oil release in New Delhi said.

The refinery site is located at Bahadur, eight km from Panipat.

The Karnal refinery design incorporates a hydro-cracker unit as the key secondary processing facility to maximise yield of middle distillates, comprising mainly kerosene and diesel, which constitute nearly 60 per cent of the total consumption of petroleum products in the country.

Though Indianoil is setting up a hydrocracker unit at its Gujarat refinery, it is for the first time that the facility has been planned at a grass-roots refinery.

According to the DPR, the Karnal refinery project shall cost Rs. 1400 crores at current prices. The foreign exchange component is anticipated at Rs. 450.50 crores. The revised cost takes into account inflation since the earlier approval of the proposal and the minor changes in scope of the project which became necessary while firming-up the design and processes scheme.

Financing of the project shall be on the basis of debt: equity ratio of 4:1. Of the total share capital of about Rs. 280 crores, 52 per cent will be shared equally between the co-promoters — Indian Oil Corporation and

Tata Chemicals. The balance would be raised from the public including non-resident Indians. The issue of convertible and non-convertible debentures has also been envisaged.

The joint venture company would be incorporated under the name and style of Tata-Indian Oil Refineries Ltd. (TIROL). Government's clearance on IOL's application 'under MRTP Act and the Companies Act is awaited in this regard.

BIHAR TOPS IN COPPER RESOURCES

Bihar along with Madhya Pradesh and Rajasthan possess 90 per cent of the country's copper resources.

Official sources said Bihar is on the top with 46 per cent, Rajasthan has 20 per cent and Madhya Pradesh 25 per cent. Assuming a sustained three per cent growth of demand after 2000 AD, the total amount of copper needed

for the next 30 years will be 11 million tonnes.

According to the sources the static life of the copper resources of the working mines, at 65,000 tonnes per annum, is 24 years, based on the assumption that 50 per cent of the reserves are recoverable.

The sources said schemes for the debottlenecking and modernisation of the smelters and refineries both at the Indian copper complex in Bihar and Khetri copper complex in Rajasthan are under implementation.

With the present knowledge of the copper ore reserves in the country the only promising prospect for increase in copper production appeared to be in the Singhbhum copper belt in Bihar and Malankhanj in Madhya Pradesh.

The feasibility study for integrated development of the Singhbhum copper belt is in progress. Unless new deposits of large dimensions like Malankhand are explored and exploited, even 50 per cent of the demand cannot be met.

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Commercial plan for CSIR labs drawn up

An empowered group, set up to look into the financial management of the CSIR (Council of Scientific and Industrial Research) laboratories, has suggested a high commercial strategy for boosting internal resources generation of CSIR family.

The group consisting of experts from all walks of life, has opined that the consultancy fee for the CSIR technology should be raised, industrial units both in the public and the private sectors should be invited to become associate members on a payment and CSIR should tender for projects in the private and public sectors. Besides, the group has suggested that the government deductions from the CSIR's earnings should be retained by the council. Other recommendations include CSIR helping the private industry in setting up R and D centres and greater interaction with the industry in commercialising the technologies developed in the CSIR laboratories.

The group's recommendations will be soon sent up for the Prime Minister's approval.

The group was set up in the light of the Abid Hussain committee's suggestions that the CSIR laboratories should earn at least 33-1/2 per cent of their budgetary expenditure. The recommendation initially did not find favour with the CSIR experts but was accepted by the CSIR society, an apex body chaired by the Prime Minister.

According to official sources there are only 5 laboratories which are earning more than the projected 33-1/2 per cent requirement. A large number of labs are still struggling to hit the figure. The Abid Hussain committee had suggested 1992-93 as the cut off date to achieve this target. It was decided to work out a comprehensive strategy to be implemented by all the labs.

The committee has said that CSIR did not accord priority to the marketing of its R and D efforts. It felt that if it went about selling its technologies in a scientific manner, there would be a sharp increase in its internal resources.

During 1987-88, the budgetary support or the "core" money given to CSIR by the finance ministry was 200 crores, out of which Rs. six crores were given to the government. The internal resources were expected to go up to Rs. 50 crores during the current financial year.

The committee has suggested that besides increasing its technology fees, CSIR should also invite large industrial undertakings to become its associate members on payment of a fixed fee per annum. In return, the council will meet the R and D requirements of the concerned organisation, give it R and D support and also provide it with testing facilities. The group felt that this would not only mean additional income for the council but also a better interaction with the industry in the private as well as public sector.

The suggestion relating to tendering for large projects aims at commercialisation of the technologies or know-how developed by CSIR. The council has in fact started implementing the suggestion. It bagged an ONGC tender for preparing risk and hazard analysis for the chemicals and highly explosive inputs used by ONGC. This would be a test case for the Indian technologies to compete with the multinationals which are in the field of frontier technologies.

The group feels that the government deductions out of the internal resources should be stopped. In this context it has suggested that besides the "core" money, the government should give financial incentives to the laboratories whose performance is above the mark.

Additional resources can also be generated by the council by setting up R and D centres for large industrial units. As the government has made it mandatory for the large companies to have an R and D cell, the council could play a leading role in this direction. The group has pointed out that the council has a weak base in transferring technology from the lab to commercial stage. The group feels that the industry should be asked to set up either pilot plants through the highly sophisticated CSIR mathematical models to go in for commercial production. This would save a lot of cost to the council.



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Aluminium phosphide poisoning in N. India

Doctors have warned of widespread aluminium phosphide poisoning in North India following several reports of human consumption of this chemical used in grain storage.

Aluminium phosphide is a common fumigant that protects stored grain from being eaten up by pests. It is safe to handle and does not affect the grain.

But doctors at the All-India Institute of Medical Sciences (AIIMS) in New Delhi, say several hundred people have died in recent months after the deliberate or accidental ingestion of the chemical which is as dangerous as cyanide if swallowed.

The AIIMS report is based on its own data and on medical reports from other hospitals in neighbouring states.

Doctors say the easy availability of the chemical is one factor that has made it one of the most common poisons used. "If this goes unchecked, it could spread out," Professor H. S. Wasir senior AIIMS cardiologist said.

The guidelines for pesticide use rule that aluminium phosphide can only be used by government organisations and pest control operators with technically qualified personnel. Dr. R. L. Rajak, plant protection adviser in the directorate of plant protection, quarantine storage, said.

Both doctors as well as agricultural scientists, however, believe that despite these restrictions, there are "leaks" which make the chemical fairly easy to get. "There seems to be an easy access to the substance," said Dr. Rajiv Bajaj who co-authored the AIIMS report.

In a report in the Journal of Association of Physicians of India (JAPI), doctors from a medical college in Rohtak (Haryana) say they have come across 114 cases of acute aluminium phosphide poisoning in just one year.

The January 1983 issue of JAPI also has reports from a medical team in Meerut (Uttar Pradesh) which has reported 55 cases and doctors in

Gwalior (Madhya Pradesh) who have cited 30 cases.

What is causing concern among doctors is that aluminium phosphide which is almost always fatal acts rapidly in the body and there is no effective treatment or antidote. The chemical releases phosphene gas in the body and prevents cells from using oxygen. Victims die within hours. The action is similar to that of cyanide.

Forensic scientists who have to conduct autopsies on poison victims also say that aluminium phosphide has become one of the most widely used poisoning agents.

"Now the first thing we do with a victim is look for phosgene in the body", a senior forensic doctor from Haryana, currently at the institute of criminology and forensic science in New Delhi said.

The first reports of the misuse of aluminium phosphide for poisoning appeared in local journals in 1983, AIIMS doctors said. A handful of teaching hospitals have reported hundreds of cases during 1987, the doctors said.

At AIIMS last year doctors had 15 cases of aluminium phosphide poisoning in only three months.

Doctors suspect that scores of cases may have gone unreported mainly for two reasons: most victims coming from rural areas tend to go to district hospitals from where no data is available.

Scientists at the Indian Agricultural Research Institute (IARI) in New Delhi say aluminium phosphide is in great demand among farmers who find it a very convenient and inexpensive fumigant.

Just a few grams can protect several hundred kilograms of grain for many months, said IARI entomologist, Dr. T. D. Yadav, but it is hard to prevent something from being misused, he added.

In the Lancet report, the AIIMS cardiologists have suggested that the chemical should be banned for public use.

EASING TRADE WITH INDIA: PAK EXPANDS IMPORT LIST

In a major move to liberalise its trade with India, the Pakistan government has expanded the list of items that can be imported from this country by registered trading houses from 42 to 249.

The enlargement of the import list by 207 items is expected to create new and greater avenues for effective private sector trade between the two countries.

The 249 items now thrown open for import from India include such non-traditional industrial items as newsprint, oilseed and edible oils, rubber, wool, aluminium waste and scrap, aircraft and engines and a host of chemicals and metals.

The liberalisation of Pakistan's import regime, which was seriously inhibiting bilateral trade with India, follows the meeting of the commerce secretaries of the two countries in December 1987 in New Delhi and of the visit earlier of then finance minister V. P. Singh to Pakistan in January 1986.

India has been running a negative trade balance with Pakistan since 1979-80 when Pakistan enjoyed a trade surplus of Rs. 16.19 crores. In 1986-87 the surplus was down to Rs. 14.56 crores.

Trade and industry circles in New Delhi, however, favour a formal trade agreement between the two countries which allows import of all items in which Indian suppliers are competitive. They also suggest the opening of the Wagah border to facilitate smoother flow of trade, free and more frequent exchange of trade delegations and simplification of travel and visa formalities.

The following are some of the items which can now be exported to Pakistan: metals, waste/scrap (non-ferrous) excluding fired aluminium forced ammunition cases; bitumen/asphalt, natural/bituminshale/ asphaltic rock/tar sand; formic acid; salicylic acid; aniline; titanium oxides; ferrous sulphate; Synthetic organic dyestuff (including pigment dyestuffs); mercury chloride; clay/andalusite kyanite etc excluding expended clay head; sodium salicylate; acetyl salicylic acid; regenerated cellulose; ferro manganese.

COMPANY NOTES

THIRUMALAI CHEMICALS

Thirumalai Chemicals is one of the four units in the private sector engaged in the manufacture of phthalic anhydride — an intermediate which finds application in diverse industries such as PVC compounds, paints, dyes and pigments. The marked improvement in these industries, particularly dyestuffs both in the domestic as well as global market had led to a tremendous upsurge in the demand of phthalic anhydride.

This 15-year old company having its unit in Tamil Nadu has been able to take full advantage of favourable market conditions. Income at Rs. 32.11 crore during the year ended December 1987 reflects a growth of more than 50 per cent over 1986 and nearly 162 per cent over 1985. What is more, the rise in gross profit is even better at Rs. 5.33 crore against Rs. 2.34 crore, an increase of 128 per cent. The profit margin as measured by gross profit in relation to net sales has improved significantly to 18.7 per cent from 12.4 per cent in 1986.

Even after providing for higher depreciation (Rs. 4.00 crore against Rs. 2.41 crore which incidentally includes arrears of Rs. 1.58 crore following change in method of computation) and taxation on (Rs. 18 lakh) and also previous years losses, the net profit is Rs. 1.15 crore. This is in sharp contrast to the loss of Rs. 7 lakh reported in 1986 and Rs. 15 lakh in 1985. With the average earning per share being Rs. 5.75, the Directors have been enthused to step up the dividend by ten points to 20 per cent.

The encouraging performance follows an all round improvement in production and sales. Production of phthalic anhydride was 18,274 tonnes against 14,321 tonnes in 1986 an increase of about 28 per cent. The company also recovered 136 tonnes of maleic anhydride from the effluent gases against 90 tonnes in the previous year. Sales of 16,682 tonnes (previous year 14,163 tonnes) fetched Rs.

31.76 crore (Rs. 20.96 crore). The average price realized was Rs. 19.04 per kg against Rs. 14.80 per kg. Maleic anhydride fetched Rs. 34 lakh against Rs. 24 lakh.

On the export front, the company earned Rs. 2.23 crore against Rs. 1.62 crore. Export markets included Taiwan, Singapore and Thailand. The average realization on exports at Rs. 14.27 per kg was, however, lower than the domestic prices.

As against the export income of Rs. 2.22 crore, the company had to spend a higher amount of Rs. 16.97 crore (against Rs. 10.47 crore) on import of ortho xylene, the basic raw material. The average price paid for ortho xylene was also higher at Rs. 9.28 per kg against Rs. 7.32 per kg. Besides the increase in raw material prices, the company had to spend more by way of power and fuel charges (Rs. 1.97 crore as against Rs. 1.27 crore) and personnel expenses (Rs. 40 lakh against Rs. 33 lakh). Repairs to machinery, building and other assets also absorbed Rs. 38 lakhs against Rs. 20 lakh.

Interest charges were, however, lower at Rs. 1.85 crore against Rs. 1.97 crore. This was despite higher blockage of funds in inventories and debtors. The inventories as at the end of December stood at Rs. 5.86 crore against Rs. 3.09 crore and debtors at Rs. 6.71 crore against Rs. 4.64 crore. Sundry creditors were marginally higher at Rs. 5.78 crore against Rs. 5.34 crore.

The profit margin as measured by net profit in relation to net worth works out to an impressive 21.1 per cent. Net profit in relation to funds employed is, however, 54 per cent only. In other words, the company has been able to generate Rs. 5.40 only on every Rs. 100 employed by it.

The reserves of the company stand at Rs. 3.44 crore, as against the share capital of Rs. 2.00 crore. Net block is valued at Rs. 14.37 crore.

With a view to expanding production capacity and also to reducing cost, the company has taken a number of steps to revamp the existing plants. Meanwhile, it has made an application to the Government to allow import of capital goods for the proposed maleic anhydride plant (capacity 10,000 metric tonnes).

During the first quarter of 1988 the company produced 4,879 tonnes of phthalic anhydride against 4,500 tonnes produced in the corresponding period of previous year. Despatches during the period were also better at 5,155 tonnes against 4,100 tonnes. They include 2,300 tonnes (previous year 612 tonnes) exported to China, Hongkong, Bangladesh and Thailand.

The Rs. 10 paid-up share is currently quoted at Rs. 50 on the Bombay Stock Exchange.

Courtesy: Indian Post

BASF INDIA

The prospects for BASF India during the current year are favourable according to Mr. P. M. Thampi, Chairman of the company.

Addressing shareholders at the company's annual general meeting in Bombay, he said that the overall turnover during the previous year increased by 23 per cent while gross profit increased by 41 per cent. The improved results of the company were attributed mainly to better utilisation of production, manpower and financial resources and the containment of fixed costs.

He further said that although there was an increasing competition for styropor and thermocole, the company produced to near full capacity in 1987 and expected good results this year too. Sales in leather chemicals kept pace with the growth of the leather industry and showed an increase of 24 per cent in volume over the previous year.

Sale of drum dyes and dye solutions produced at Bokaro increased substantially. It had introduced several new leather chemicals in 1987 and has plans to introduce more sophisticated types, Mr. Thampi added.

The company had received an industrial licence for the manufacture of 2,500 tonnes per annum of pour point depressants. The performance of the colours and dispersions business has also registered considerable improvement during the year, he said.

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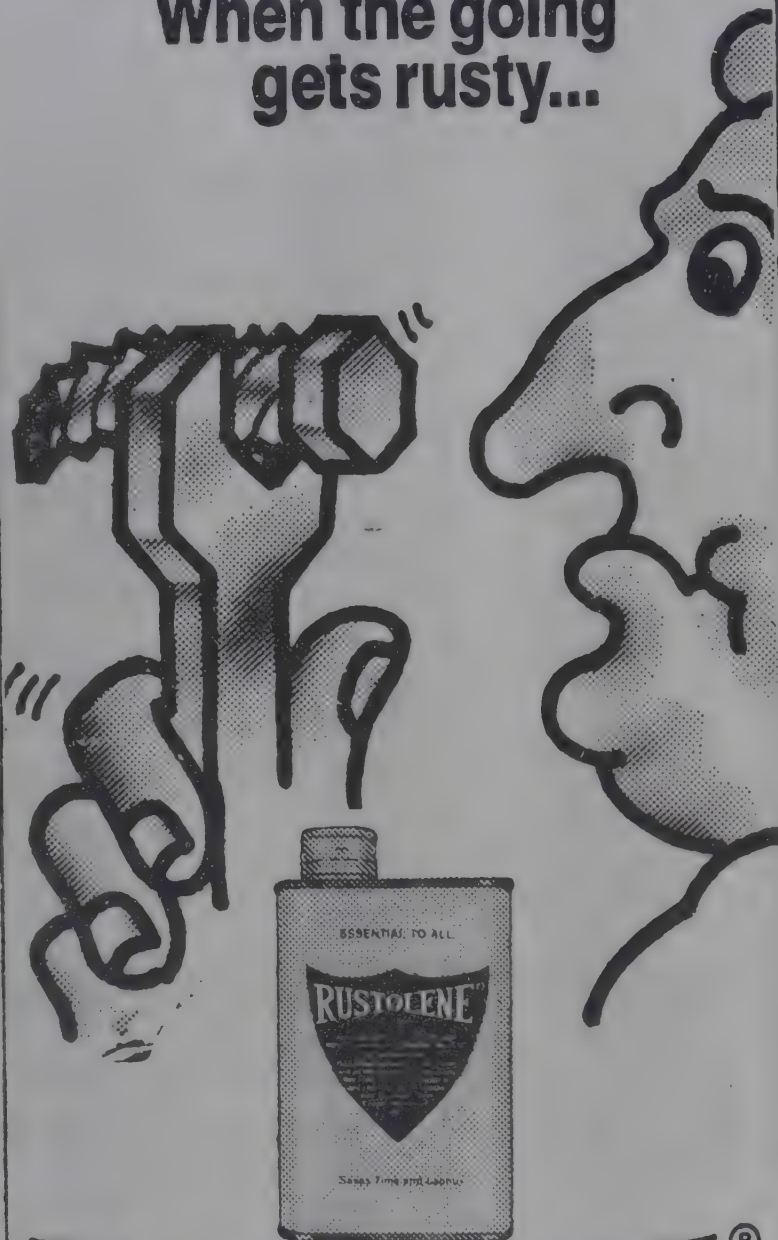
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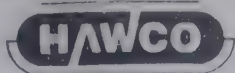


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SPOTLIGHT ON

Biotechnology & Life Sciences (Part 2)

AN UPDATE ON BIOPOLYMERS RESEARCH

A wide variety of microorganisms, including bacteria, yeasts and filamentous fungi, produce a wide variety of extra-cellular polymers as well as numerous other molecules having surface-active properties. These include certain polyamides (peptides), polyesters, polysaccharides, and combinations of these with one another and with lipids. These molecules are usually linear polymers but may be branched and often have heavily derivatized side chains. Biopolymers are used by biological systems for viscosity control, energy storage and structural containment (e.g. cell walls). Some organisms secrete biopolymers in great amounts for protection and to modify their environment; others secrete biopolymers as a mechanism of attachment to surfaces. A number of microbial biopolymers have been commercialised in advanced countries; one of these is xanthan gum.

Xanthan, produced by the bacterium *xanthomonas campestris*, is a linear polymer of glucose with short sugar side chains. Its emulsion stabilizing properties find major applications in foods (gravies, salad dressings, milk shakes, etc), as stabilizers of suspensions or emulsion in agricultural sprays, paints and cosmetics, in mining (ore settling, flocculation, slurry pumping) and in petroleum operations (drilling muds, enhanced oil recovery).

Other polysaccharides are potent bioemulsifiers potentially useful in cleaning oily sludges from storage tanks, barges and barrels, as well as

for pipeline transport of heavy crudes, fuel oils or coal slurries.

Poly-beta-hydroxy butyric acid (PHB), a plastic-like polyester is produced by a variety of bacteria. Potential uses for PHB (as well as for other biopolymers) include biodegradable bottles and packaging and slow-release medical or agricultural formulations. PHB also has piezoelectric properties that might be exploited.

Determination of structure-function relationships in biopolymers is a relatively new and potentially fertile field. Novel microbial biopolymer molecules are continually being discovered and many of these may have unique and exploitable physical and chemical properties. Research in the area is growing and is likely to focus on the development of biopolymers with specific properties, e.g. polymers for enhanced oil recovery having improved thermal stability and salt tolerance. Such studies will be aided by the ability to work with unusual organisms that in their natural habitats cope with such environmental extremes. Once the biosynthetic pathways for the production of the polymers become known, the techniques of genetic engineering may be employed to produce new 'bio' polymers with desired compositions or properties. (*Chem. Eng. Progress.*, 10/1987, pp. 27-28)

MICROBES TO PLAY A LEADING ROLE IN ENVIRONMENTAL CLEANING AND IN LAND & SEA MINING

The unique ability of several microorganisms to bind and concentrate trace elements raises exciting

possibilities in biotechnology. For many trace elements, including Fe, Ni, V, Cr, Co, Mo, Mn, Ca, Mg, Hg, Cd, Pb, Se, As and U, there are organisms that hyperaccumulate the element from extremely dilute (sometimes ppb) solutions. For iron and mercury, the genetic requirements and chemical mechanisms for this capability will soon be understood in depth at the chemical level. With appropriate effort this information could be attained for any trace element. Such efforts could lead to microorganisms or biochemicals, having remarkable capabilities in metal accumulation, which would be valuable either in environmental cleanup or in land or sea mining. (*Chem. Eng. Progress.*, 9/1987, p. 29)

ENZYME FOR CYCLODEXTRIN PRODUCTION MARKETED IN U.S.A.

Enzyme for cyclodextrin production has been recently manufactured by a fermentation process with a selected strain of *Bacillus macerans*. The purified enzyme, called *Amano CGT*, is a cyclodextrin glucanotransferase, applicable for use in the production of alpha, beta and gamma cyclodextrins. The enzyme is available in a liquid form and is standardised at 600 units/ml.

For samples and more information, write to Amano International Enzyme, Rt 250, East Zion Crossroads, Troy, VA 22974; U.S.A.

A STABLE LYSOZYME PRODUCED FROM GENE-MODIFIED YEAST

The Protein Engineering Research Institute has developed a

new method for very efficiently producing Lysozyme (a bacteria-killing enzyme). The method employs a gene-modified yeast and produces Lysozyme which contain the amino acid alanine instead of cystine (which is contained in human lysozyme). This modified Lysozyme produced from yeast is as active as but more stable than human lysozyme.

The gene modified yeast is reported to produce 8-times more lysozyme than other yeasts. This new efficient and productive method for lysozyme is expected to produce this useful bacteria-killing enzyme on a mass scale in future. A series of new drugs may develop in future based on this novel enzyme. (*Japan Chem. Wk.*, 12/31/87, p. 4)

MOVEMENTS OF LIVING CELLS MONITORED

A way of monitoring the almost imperceptible movements of living cells using an 'electrified' tissue culture dish is being developed by scientists at General Electric's Research & Development Centre. The initial result of the research indicates that at least one type of normal cell, a fibroblast, moves differently from its diseased counterpart — a discovery that if true for other types of cells as well, has implications for the technique's use in medicine or biotechnology.

G.E. biophysicists CIR Keese and Ivan Ginever reported at the recent San Diego conference on biotechnology (sponsored by the American Society for Microbiology), that the new technique tracks cell movement by recording changes in a weak electric current from an electrode at the bottom of a special tissue culture dish. The movement of cells onto and across the electrode causes perturbations in the current that are read out as signals. Such electrical 'fingerprints' might be useful in test-

ing the effects of various drug blends on cancerous cells from individual patients, or the technique might be employed in a sensor for monitoring the health of genetically modified cells in fermentation tanks. (*C & EN.*, 7/13/87, p. 21)

SHIKONIN PIGMENT EXTRACTED FROM GROMWELL'S HAIRY PLANT ROOTS

Lion Corporation (Japan) unveiled recently an efficient process to extract Shikonin pigment from the hairy plant roots of Gromwell. The yield is 1000 times more for Shikonin by this new process as compared to that obtained by the conventional tissue culture method extracting Shikonin from the callus. The comparison was made between hairy roots cultured for one month and natural Gromwell grown for 4 years.

The technology is based on the phenomenon that a large number of hairy roots sprout from a plant at a point affected by agrobacterium *rhizogenes* and produce the same secondary metabolite as that produced by their mother plant. They grow extremely rapidly when cultured by means of plant hormone free culture media. They weigh about 60-200 times — 1000-2000 times in the case of some plant varieties and culture conditions — their original weight after being cultured for one month.

In the Lion process, hairy roots are cultured within an air-lift type jar fermenter and Shikonin pigment is absorbed into culture media, which is transferred to a high polymer absorbant-packed column designed to adsorb the Shikonin. The culture media continue to shuttle between the jar fermenter and the column. It is reported that the hairy roots continue to produce Shikonin for six

months.

There is no plan at present to commercialize this new technology. However, the company envisages applying the new technique to several other plants in a bid to produce high priced plant ingredients used in perfumery and pharmaceutical industries. (*Japan Chem. Wk.*, 2/4/88, p. 5)

HIGH POTENCY FUNGAL GLUCANASE DEVELOPED BY BIOCATALYSTS LIMITED U.K.

Biocatalysts Limited, specialists in enzyme and enzyme systems in the U.K. for industrial processing, has recently introduced a new high potency fungal glucanase, with very high activity against B-glucans in barley and wheat.

Applications for the new B-glucanase called Glucanase GL include starch processing for the food industry and brewing. Under typical mash conditions Glucanase GL is effecting at reducing wort viscosity and thereby increasing filtration rate. However, the high potency of Glucanase GL increases fermentation yields and hence improves efficiency. (*Food Manufacture*, 2/1987, p. 19)

LACTOSE REDUCED COW MILK LAUNCHED IN THE U.K.

Enzymes are progressively playing a major role in providing new food products. One recent example, is the introduction of 'Lactolite' a long-life full cream whole cow's milk introduced in 1987 in Britain by Associated Fresh Foods.

Marketed as 'Lactolite', this novel dairy product has a natural lactase enzyme added to breakdown lactose into its two constituent sugars — glucose and galactose — in a similar manner to the activity of

intestinal lactase contained in the digestive system of healthy normal human beings. In Lactolite, lactose is reduced to a level greater than 5% for those who are 'lactose intolerant'. This renders this milk product much easier for the digestive system of the lactose intolerant individual to absorb through the intestinal wall. Lactolite, therefore, will allow adults and children to enjoy the taste and nutrition of cow's milk with no discomfort and with total convenience. (*Food Manufacture*, 2/1987, p. 63)

BIOTECHNICA INTERNATIONAL & HOFFMAN LA ROCHE PLAN COLLABORATIVE R & D FOR MICROBIAL PRODUCTION OF VITAMIN

Among to develop an efficient microbial strain for production of an unidentified major vitamin, Bio Technica International (Cambridge, Mass) has teamed up with drug giant Hoffman La-Roche (Basle, Switzerland) in a research and development venture. For its part, Bio Technica will contribute advanced genetic engineering technique to develop a microorganism that rapidly produces large quantities of the vitamin, which its new partner now makes. Roche will fund the collaborative programme and participate in fermentation development. Microbial production system, which basically use microbial fermentation to convert simple sugars into high-value products, have the potential of being substantially cheaper than synthetic chemical routes. (*Chem. Wk.*, 1/27/88, p. 33)

CATALYTIC ACTIVITY INTRODUCED BY MUTAGENESIS

Using site directed mutagenesis to replace a histidine amino acid residue, researchers at the University of Illinois and Northwestern University have changed the electron transfer protein cytochrome b_5 into an

enzyme that can catalyze oxidative demethylation. The redox active centre of cytochrome b_5 is an iron-containing heme group, two histidine amino acid residues at positions 39 and 63 in the protein act as axial ligands to a low spin, hexacoordinate ferrous ion in the heme. According to Illinois chemistry professor Stephen G Sligar, who directed the research, replacing histidine-39 with a methionine residue produces a mutant protein that contains a predominantly high spin heme and that can bind carbon monoxide in the ferrous state. The mutant protein catalyzes hydrogen peroxide-dependent oxidative demethylation of *N,N*-dimethylaniline, a reaction in which cytochrome b_5 is completely inactive, and exhibits dramatically altered redox behaviour from the native protein, presumably because of spin-state reorganization energy and stabilization of the ferric state by the electron-rich methionine sulfur or water oxygen. (*J. Am. Soc.*, 109, 7896 (1987))

A NEW TOOL FOR PLANT GENETIC ENGINEERING ON THE HORIZON

For several years plant molecular biologists have been using sections from the DNA of a specific bacterium *Agrobacterium tumefaciens*, as a tool for inserting foreign genes into plant DNA. Now scientists at Bio Technica International (Cambridge, Mass) have shown that bacterial genes can be moved into plants another way. The mechanism that bacteria use to exchange genes among themselves (a process called plasmid conjugation) can be mobilised to transfer genes from bacteria to plants according to researchers.

Their research not only provides another tool for genetic engineers, but raises the possibility that bacteria may have influenced the evolution of

plants by naturally inserting genes. (*Nature*, 328, 172 (1987))

BIOTECH PILOT PLANT FOR TRYPTOPHAN PRODUCTION FROM SYNTHETIC HYDROCARBONS INAUGURATED IN JAPAN

Mitsubishi Petrochemical Company has announced the inauguration of pilot plant designed to produce L-tryptophan from synthetic hydrocarbons at low cost by the use of gene-modified *E. coli*. The plant was inaugurated recently at the company's Yokkaichi factory. By operating the pilot plant, Mitsubishi intends to solve problems related to the mass production of the target product.

In the new biotech process, L-lysine and D- and L-Serine chemically synthesized from aromatic hydrocarbons are used as intermediate materials for the target product. The materials can be converted into L-tryptophan — one of the essential amino acids — in the presence of an enzyme produced by the gene-modified *E. coli* exclusively developed by Mitsubishi researchers. The production yield is reported to be as high as nearly 100%. In contrast, a similar process developed by Showa Denko K.K. using natural intermediate materials gives only a yield of around 70%. Therefore, the new process will be more economical. (*Japan Chem. Wk.*, 2/11/88, p. 4).

MAGNETIC MATERIAL BASED ON MAGNET-TACTIC BACTERIA UNDER DEVELOPMENT

TDK Corporation's biotech researchers are endeavouring to develop new magnetic material on the basis of research on magnet-tactic bacteria. The basic research on this subject was initiated by Assistant Prof. T. Matsunaga at Tokyo University of Agriculture &

Technology. According to this basic research magnet-tactic bacteria—both natural and cultured ones—synthesize fine magnetic particles having large magnetic moment. Their size is so miniscule (500 Å)—one tenth that of Zn ferrite particles—that the surface area per unit volume is large. The researchers have observed 100-times more enzyme can be fixed on this microbial magnetic particle than in the case of Zn-ferrite particles. These particles are identified as magnetic because they show the same diffraction pattern of electron beams as pure single-crystal magnetite. It has also been confirmed that their main ingredient is iron.

In future it may be possible to produce magnets having ultra-high magnetic intensity by uniformly combining the five magnetic microbial particles at high density. The researchers are busy establishing culture technology for the above magnet-tactic bacteria and investigating practical uses of the microbial magnetic particles. (*Japan Chem. Wk.*, 2/11/88, p. 5).

A BIOLOGICAL DEODORIZING PROCESS BASED ON MICROBES

Kajima Corporation (Japan's leading construction company) has developed a biological deodorizing process based on microorganisms. It has inaugurated last December a trial operation of a biological deodorizing system comprised of a base mat consisting of vermiculite, peat moss and microorganisms. The new system is designed to remove offensive odour from an inhouse-developed windowless pigpen using the above base mat (of vermiculite, peat moss and special microorganisms). The base that is 70 cm thick, 2 metres long and 3 metres wide. The company plans to continue the trial operation until next summer and then decide on commercialization of the pilot plant by the end of 1988.

The development of the above

biological deodorizing system began years ago from the company's R & D on the removal of acetic acid odour. This extensive research led to R & D on the odour removal of nauseating pigpen odour. The research results obtained showed that the biological deodorizing process requires 60% water and showed that microorganisms living near pigpens have a high deodorizing capacity. (*Japan Chem. Wk.*, 12/31/87, p. 4)

SUCCESSFUL CUTTING OF HUMAN CHROMOSOME WITH LASER BEAM UNVEILED

Hamamatsu Photonics K.K. and National Institute of Agro Environment Science have together succeeded in cutting human chromosomes at any desired site by means of a laser beam. This is a new landmark in biotech research. The method according to researchers will greatly facilitate in future the mapping out of a human linkage map as well as R & D work in biotechnology. So far conventional methods were struggling to make a linkage map employing restriction enzymes etc. These methods are cumbersome and time-consuming.

The Western and Japanese researchers have before them an urgent task to work out a human linkage map for R & D on genetic mechanisms for the treatment of serious inherited diseases. With new laser system, an argon laser beam is applied to a desired site of a chromosome separated under the microscope. Laser application is controlled by a computer. The equipment developed by the company is designed to cut a chromosome and obtain a chromosome piece of at least 0.3 micron width in a second. The portion cut off can be recovered by a centrifugal separator, etc. The 0.3 micron piece cut off consists of 12 million base pairs and this size is a little smaller than the chromosome of *E. coli*. (*Japan Chem. Wk.*, 1/26/88, p. 5)

MUTANT YEAST APPLIED TO ERYTHRITOL PRODUCTION

National Food Research Institute and Nikken Chemicals Company, both of Japan have jointly pioneered production of erythritol (a sugar alcohol) from grape sugar by a biotech process employing a mutant yeast. In this new biotech process, erythritol is produced by fermenting grape sugar by means of using *Aureobasidium* SN-115 yeast.

The researchers were able to produce 47 gms of the product from 100 gms of grape sugar employing biotech method comprising filtration, refining, concentration and crystallization processes.

The yeast is a mutant capable of living under high osmotic pressure and producing erythritol without forming foams. It can be employed even in the case of highly concentrated (35%) grape sugar. In nature erythritol is contained in Lichens (content 0.3~0.5%), mushrooms (2~4%) and in Sake, wine and sherry. The % content being so low, it was not possible to extract erythritol from natural products commercially. Therefore, application of erythritol to food products has not been possible so far.

A potential application of erythritol in diet as a sweetener is on the horizon. Erythritol is hardly metabolized within the human body and by enteric bacteria. It is less hygroscopic and has sweetness equivalent to 80% of that of sucrose. These properties make it very useful as a no-calorie sweetener in obesity and for diabetics. Due to these advantages the product will be applied to production of table sugar, confectionaries and other types of food and some chemical products. Nikken Chemicals is planning to put the product on the market around 1990 after developing production facilities for this useful sugar alcohol. (*Japan Chem. Wk.*, 1/28/88, p. 5).

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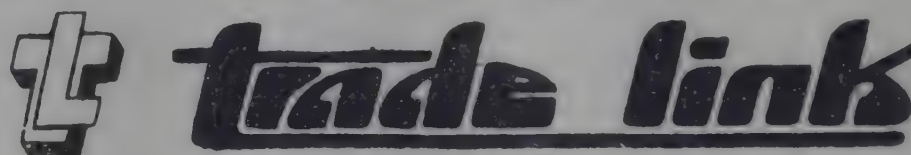
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Application of Microprocessor in the Rayon Industry

Dr. G.R. SARAF, Mr. SUNIL MEHRA, Mr. ANISH MEHTA, & Mr. M.U. SRINIVAS
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INTRODUCTION

In India the existing Chemical Plants are, in general fast becoming obsolete in terms of the process control equipments used in these plants. In a good number of cases, the modernisation of the control system by utilizing advanced measurement and computing devices can make such old plants competitive with new plants.

In chemical plants, there is a need to control number of variables viz, the physical and chemical characteristics of different raw materials, the process conditions such as pressure, temperature, flow rate etc, the performance of various heat exchangers-evaporators, condensers, reactors, cooling towers along with other process equipment such as pumps, compressors, distillation columns etc. Today chip based control systems are the most advanced in all areas of control. The field of chip control is growing rapidly and achieving widespread industrial recognition and acceptance. Furthermore, the application of the microprocessor based control system usually demands a much lower capital investment in modernising these plants than replacing it with a new plant. This results in an excellent return on the investments.

In this paper, the efforts have, therefore, been made to study the feasibility of the use of microprocessor chip in the Rayon Industry. The microprocessor is the ideal choice because this chip when combined with memory and input-output devices forms an excellent system to monitor and control operations and processes. The salient features about its use are its immense flexibility in operation and the economical nature of the whole set up.

Rayon in the rayon industry is manufactured from wood pulp which may be available as pulp sheets or pulverised wood pulp. The wood pulp is first converted to a very important intermediate called viscose by a process known as Xanthation. Viscose is then converted into the desired rayon-grade fibre in the spinning and weaving department of the industry. The two most important chemicals required for the process — carbon-di-sulphide (CS_2) and sulphuric acid (H_2SO_4) are also usually produced internally by the industry. In order to meet the requirement of power necessary for

all these processes, in general, industries have their own power plant.

The feasible application of microprocessor is studied in the Rayon Industry by classifying it to its various divisions such as Viscose division, CS_2 plant, H_2SO_4 plant and power plant.

VISCOSE DEPARTMENT

In this division there are two main operations — simplex operation and dissolver operation where efficient control of quality can be achieved by the application of microprocessor. In simplex, the process known as xanthation or sulfidation takes place which converts the cellulose into a soluble derivative.

The rate of xanthation and its quality mainly depends on temperature, pressure and amount of CS_2 used. These parameters are maintained manually, which obviously affect the properties of the viscose being produced. Andulkar and Saboo(1) suggested the use of microprocessor to coordinate all the operations that need to be performed in the simplex. The microprocessor would provide the indications about the operations that are to be performed along with sound alarm. On hearing the alarm the operator will then perform the required operation and acknowledge the microprocessor by pressing the acknowledgement switch. The microprocessor will also be supplied with two counters to measure the consumption of CS_2 per day and the number of batches xanthated. This type of microprocessor based control applied simultaneously to number of simplex units is expected to be economical and would result in better quality and production of viscose, increased safety and reduced total operating cost.

The dissolver operation is a batch process which follows the xanthation process. Here the undissolved viscose formed in the simplex division is stirred continuously for a fixed period of time before being sent for the final filtration.

All the operations like opening and closing of valves controlling the motors for stirring and pumps for pumping viscose to blenders, controlling the temperature of

viscose in the dissolvers and maintaining it in between the desired limits are carried out manually at present. This influences the quality and production of viscose.

The microprocessor based system can make it possible to control the complete process from an operators keyboard panel. This will require interfacing the necessary instrumentation with the microprocessor and other chips like the memory chips, the input-output ports and the timers. The entire operation will be controlled by the microprocessor by issuing the interrupts at the right port. The interrupts will be timed using down-counters or timer chips. One of the most important tasks is to make sure that the stirrer or impeller motor is always running. A failure of the stirrer motor can lead to the clogging of the half-formed viscose inside the dissolver and following this the entire dissolver tank has to be replaced in most cases. This task can be performed excellently by the microprocessor by sensing the failure of the motor almost instantly and sending out an alarm. With suitable hardware, the microprocessor can also carry out the starting of the stand-by motor in case of a failure. Other failures which may provide electrical signals can also be detected and controlled by using the microprocessor based control system.

One of the key parameters which affects the most important property of viscose — the ripening index is the temperature of viscose in the dissolver. The temperature of viscose in the dissolver tanks rises steadily due to the heat produced by the stirring operation. This is controlled by allowing chilled water to flow through the dissolver jacket. Hattikudur et.al.(2) developed the hardware to control temperature rise in the dissolver by regulating the chilled water flow. In order to achieve this, control microprocessor would be programmed to function as single-loop temperature controller. The controlled variable is sampled at discrete intervals of time through temperature sensor (RTD) and its deviation from set point is calculated.

CS₂ DIVISION

In CS₂ division, the efficiency of the plant can be improved by controlling temperature profile in the furnace for melting sulphur, regulating electrical input to the furnace, minimizing the problems of clogging of baffle box and scaling in condenser. Microprocessor based system is proposed by Naronha et.al.(3) to carry out these controls.

For the optimum production of CS₂ in CS₂ refinery, the electric input to the furnace should be sufficient to completely vapourise the liquid sulphur entering through

feed lines from the distributor. If the power input is less, the charcoal bed is not heated to the required temperature and unvapourised liquid sulphur collects at the bottom of the furnace causing wastage. The liquid sulphur forms a film envelope over a mass of charcoal. The reaction taking place within the envelope causes a pressure build up. This in turn results in envelope burst. A surging of charcoal bed then leads to a flap burst.

This harmful bursting can well be controlled with the help of microprocessor based system. The temperature readings from 8 chromel-alumel thermocouples placed in the furnace are continuous input to the microprocessor. If the average furnace temperature falls below the preset limit, the microprocessor will change the power level appropriately and an alarm is also raised to take other precautionary measures.

The temperature inputs from 8 thermocouples are also used to determine the corrective measures with the help of software(3) developed for maintaining the temperature profile in the furnace.

Furnace has its own condenser system. Sulphur and charcoal particles entering the primary condenser along with CS₂ vapours, at times tend to clog the baffle box, which causes an increase in pressure in the furnace which is undesirable.

For controlling furnace pressure a steam coil with solenoid valve can be used. The microprocessor senses the pressure difference across the baffle box. If this valve is greater than a preset value (the desired pressure difference across the baffle box when no clogging occurs), the microprocessor activates the solenoid valve. The amount by which valve should be opened is computed with the help of a software and appropriate signal is provided to the terminal for taking corrective action.

In this case, when the valve opens, the steam, flowing through the tubes melts the solid sulphur and unclogs the baffle box.

Scaling inside the condenser tends to reduce the heat transfer coefficient and hence the condensation efficiency of the condenser. To counter this problem, the microprocessor senses the inlet and outlet temperatures of the water by means of chromel-alumel thermocouples. The difference between the input and output temperatures (say ΔT measured) is compared with a preset difference value (ΔT preset) stored in the memory.

If ΔT measured is less than ΔT preset, either the mass flow rate of cold water is high or the scale on the

surface, has reduced the heat transfer coefficient to a small enough value to call for a maintenance shut down.

The microprocessor checks the flow rate. (the value of mass flow rate of water for different temperature across the clean condenser are determined experimentally and are stored in the memory of the system for comparison). If this is found to be within the limits, then the second cause is indicated through a buzzer on the control panel.

POWER PLANT

In order to monitor various parameters continuously and accurately in a existing power plant, a Data Acquisition System (DAS) is studied(4).

A DAS is essentially a replacement for conventional indicating, recording and alarm annunciation instruments. It has many advantages over these conventional instruments. It continuously monitors various parameters and provides audio visual alarm as soon as any parameter exceeds predefined limits. Alarms can also be given based on mathematical computations involving various process parameters. It provides on line real time plant data. It supports bulk memory devices like floppy discs and it allows remote multiplexing which can result in substantial saving in cabling cost.

However, the use of DAS with a system consisting of conventional indicating and recording instruments poses a few technical problems related to interfacing the DAS to existing instrumentation, viz (i) It may be required to install RTD to current converters in control room and feed the current to the recorders and DAS. This may involve a change in the recorder as well. (ii) Wherever inputs are available as pneumatic signals, P/I converter has to be used. (iii) In cases where it is difficult to lay cables multiplexer-boxes can be used.

The installation of DAS is expected to increase plant safety, minimise operating errors, reduce energy consumption, enhance equipment life, and reduce human labour etc. Proper control of various parameters would result in better plant efficiency.

H₂SO₄ PLANT

Sulphuric acid in the H₂SO₄ division is produced by the contact process. In this process, SO₂ (Sulphur dioxide) gas is first produced from an appropriate raw material, which after cooling, purification and drying is reheated to the desired level and oxidized to SO₃ (Sulphur trioxide) gas in the presence of a suitable catalyst.

The SO₃ gas thus obtained is then cooled and converted to sulphuric acid by absorbing it in concentrated H₂SO₄.

R. Karthikeyan et. al.(5) have suggested the use of microprocessor based system for controlling the process in the H₂SO₄ division. The areas that have been identified for the purpose of control are the sulphur burner to monitor the temperature of molten sulphur, sulphur burner to control the proportion of SO₂ in the outlet gas, waste heat boiler to monitor the temperature of outlet gases from boiler, converter to control the temperature of gases from the first, second and third bed of the converter, first stage heat exchanger to control the outlet temperature, SO₃-cooler to monitor the temperature of outlet gases and the acid circulation tank to control the concentration of acid being circulated in the tank.

The control of critical parameters such as temperatures at various stages of production, the SO₂ percentage from the burner and the acid concentration in the acid circulation tank, is a must in the H₂SO₄ production and have therefore, been considered for automatic control scheme, whereas the non-critical parameters are just logged periodically so that the plant personnel can keep a watch over them.

In order to solve this control problem, R. Karthikeyan et.al.(4) suggested two basic approaches — the on line control and the off-line control schemes. In the on line control scheme (also known as closed loop control) the critical parameters are automatically controlled and logged, whereas all other process parameters are only determined and logged. In this scheme, the control was carried out for 24 variables. The entire design consisted of three microprocessor chips in the controller mode with eight variables being controlled by each. The operator interface was provided for changing the set point of each of the 24 controlled variables at any time. They tested the suitability of both feed forward and feed back modes for different controlled variables and found that in general feed back scheme is simple and more economical. However, they observed that the feed back scheme controls best the waste heat boiler and the SO₃ cooler while the feed forward scheme is best suited to the sulphur burner.

In the off-line (open-loop) control scheme, the controller provides warnings to the operator if the process parameters go beyond the preset limits. This scheme with data acquisition system controls 10 variables, logs 64 variables and prints out the values of each of these variables after every 15 minutes. The critical parameters

ters are given the priority in logging to facilitate easy scanning. The data acquisition system is also microprocessor based with a suitable printer. The suggested operator interface provides a LED digital display, indicator lights for each of the critical variables, keyboards for changing the set points and the usual alarms. They also found that off line type of control system is practical with the present set up because it calls for minimum changes.

CONCLUSIONS

This paper reviews the possible use of microprocessor based control systems in the rayon industry. This study reveals that apart from enhancing the process efficiency, such a system also assures a better quality of the product mainly due to the process and accurate nature of control obtained. The system also minimises human error and reduces the risk of accidents caused by human involvement. The improved operator interface enable process engineers to implement decisions at the touch of a button, thereby allowing plant management more time to implement effective informed decisions. A microprocessor based control system also provides an

economical and superior alternative to the existing control systems.

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Chemical News from Abroad

CLAL, DELEK BUY GADOT TAKE FROM JOHANANOFF

Two of Israel's industrial giants, the Delek oil company and the Clal conglomerate, have each taken a 26 per cent stake in Gadot Petrochemical Industries (GPI) in a deal believed to be worth around \$10m.

The move will help GPI to solve its debt problems with the backing of two of the country's strongest economic organizations, to proceed with projects aimed at enlarging existing production capacities and to set up new grassroots projects.

It is envisaged that GPI will go ahead with plans for a styrene plant at Haifa while probable candidates for expansion are the company's aromatics and citric acid operations.

Sources in Israel say that, under its new management, GPI has a good chance of moving into profit after reporting losses of around \$10m last year on sales of \$75m.

The 52 per cent stake acquired by Delek and Clal was purchased from the Johananoff group which is left with a 19 per cent shareholding in GPI. The two have a further option to buy this holding at a later date. Johananoff was forced to relinquish the major part of its stake after pressure to repay bank loans that it had taken out to revitalize its financially troubled chemical trading arm, Fluidiks. The trader's future — which has been in the balance for some time now — looks cloudy.

The business previously handled by Fluidiks will, at least in the short term, be taken over by

CT Chemicals, the trading arm of Clal Subsidiary Chemical Ltd.

The deal will be formalized when the Haifa Oil Refinery, which holds 26 per cent of GPI, waives its right to first refusal on the Johananoff shares. But informed sources in Israel say this is inevitable as the ministry of finance is determined to push for privatization of state-owned enterprises.

The management at GPI is to remain basically unchanged apart from the replacement of the current chairman, Moshe Johananoff, by Delek managing director Abraham Agman.

GPI produces 180,000 ton/year of aromatics of which some 120,000 ton/year is exported. Clal's only previous involvement in chemicals manufacture was a small acrylic fibres plant in Israel. In 1986 Clal and Gadot merged their competing chemical storage and distribution companies into a new company Gadot Chemical Terminals (1985) Ltd.

Delek, the second largest gasoline distributor in Israel, is believed to be keen to diversify into the aromatics business in response to the deregulation of Israel's gasoline sector.

CROS MOVES IN ON ERT

Draft agreement has been reached to give seats on ERT's board to four representatives of the KIO-Cros-Torras group.

The draft agreement calls for all board decisions to be unanimous which would give Cros veto power. Two of the new members have been named: Juan Antonio Delgado who becomes managing director, and current Cros chief Francisco Go-

dia who becomes a vice-president. One of the other appointments, it was indicated, will come as a surprise to the industry.

The agreement provides the go-ahead for the Spanish government's plans to merge Cros and ERT's fertilizer operations into a jointly owned company, Fosforico Espanol. It involves Cros paying Pta9bn (\$79m) to ERT which will be a step towards reducing its Pta66bn debt burden.

The Kuwaiti involvement means ERT's defence business will probably become a separate entity. It is unclear whether chairman Jose Maria Escondrillas — who opposed KIO's involvement from the outset — will remain.

BEROL DEAL CLOSE

No clear leader has yet emerged in the race to acquire Swedish speciality chemicals firm Berol Kemi. But the field appears to have narrowed from the original list of bidders, believed to have included ICI and Burmah in the UK, Akzo of the Netherlands, the US firm Air Products, and fellow Swedish concerns Nobel Industries and Perstorp.

The three latter companies — and possibly one other — are still reckoned to be in the running. An outcome is now expected by the end of this month.

SNIA DETAILS SPENDING PLANS

Italian Chemicals, defence and space group Snia BPD, which is set to report sales of L2.4 trillion (\$1.93bn) for 1987, is to invest over L1 trillion in the next three years to strengthen its fine chemicals, fibres, engineering polymers and bioengineering operations.

The plan, which has trade union backing, involves trimming the workforce of some 16,000 by about 1,500, mainly through early retirement and internal moves. But Snia also plans to create 400 new jobs.

Snia aims to spend L550bn to consolidate and advance its processes and products with a further L200bn going on knowhow and research. Some L155bn of the overall research effort will be directed at chemicals. Acquisitions and investments will account for a further L300bn.

Plans for the chemicals sector include setting up joint ventures to secure raw material supplies and strengthen specific areas. Integration in pesticides will be achieved by concentrating on developments in high added value biopesticides.

Meanwhile, Snia is exiting the fertilizer sector. Rationalization of the fibres business, for which L160bn has been set aside, is planned with developments again centering on added value areas.

Snia's bioengineering business is looking to broaden its product range and overseas distribution network to increase exports. The group plans to boost its diagnostics operations through research, process rationalization and completion of fast growing product areas.

Also in the pipeline is the development of new products in cardiology while, in a joint venture with Enichem, Snia is looking to establish a major venture in the blood treatment sector.

SHELL TO EXPAND SHOP UNIT, MAY BUILD PIPELINE

Shell Chemicals is to expand capacity of its Shell higher alpha olefins (Shop) plant at Stan-

low, Cheshire, UK. The 320,000 ton/year unit produces higher olefins, used mainly captively by Shell for its detergent intermediates, auto additives and other businesses.

Current capacity will be increased by 50,000 ton/year, at a cost of \$10m. There is plenty of scope for further low cost expansion, however, Shell says, and the company could eventually take capacity to over 400,000 ton/year to satisfy European higher olefin demand into the 21st century. Reports say Shell is poised to spend \$150m on expansions at Stanlow. It is already spending \$30m on a propane/propylene splitter there.

A major question in any expansion plan would be the sourcing of ethylene for the Shop project. At present Shell receives ethylene at Stanlow and Carrington, UK from the Mossmorran ethylene cracker at Fife, Scotland which it built jointly with Exxon Chemical.

Some 300,000 ton/year of ethylene is transferred by pipeline from Fife in various legs, each operated by different companies, including BP, ICI and Shell. Shell denies there is any acrimony between itself and ICI over the cost of transmitting ethylene through the leg of the pipeline owned by ICI, running across the Pennines mountain range in northern England. The pipeline currently runs at its full capacity as it also carries 200,000 ton/year of ethylene for ICI from its operation at Wilton, Teesside, to its Hillhouse, Lancashire and Runcorn, Cheshire operations.

Shell says it is now considering building its own pipeline at a possible cost of \$75m to take ethylene across to Stanlow. In addition, however, the company

says: "Discussions are continuing with ICI to explore greater utilization of the existing pipeline."

Shell could install another compressor to hike capacity of the existing line. This was done in the past, when it paid for a compressor to be installed by ICI at its Clitheroe, Lancashire, site. A second Shell-funded compressor is already being installed.

One source of extra ethylene could be Mossmorran, if Shell could arrange to receive a greater share of the output, through a swap deal with its partner in the project, Exxon Chemical. Exxon is the operator of the Fife plant and has just announced a 50,000 ton expansion there, raising capacity to 600,000 ton/year. Shell says it is exploring a number of possibilities for procuring extra ethylene, including a swap with third parties and it hopes to sort out its preferred option by mid year.

Another possible contender for ethylene from the Fife cracker is Ethyl of the US, which is seeking a site in Europe for a grassroots alpha olefins unit. That company needs to procure 20,000 ton/year of ethylene and has been talking to BP Chemicals, Exxon Chemical and ICI in the UK, as well as potential suppliers in Belgium. Site selection has been narrowed to these two countries, and will depend to a large extent on ethylene supply, Victor McDearman, director of industrial chemicals in Brussels confirmed.

The unit would not start up until 1991. It represents the single biggest new ethylene-using project in Europe and Ethyl would need ethylene supply commitments later this year.

hyl is the world's largest
lier of alpha olefins and wo-
overtake Shell as Europe's
est supplier if the latter did
expand its Stanlow unit.
It says its current plans are
part of a race with Ethyl. The
companies will be vying for
orce supplies of ethylene, ho-
ver.

CECIC WELCOMES MERGER TASKFORCE

The initial response from Ce-
the European chemical indus-
federation, to plans for a
dy to vet crossborder mergers
positive. Celic says there is a
ed for a pan-European body
at can have a final say over na-
tional regulators and it welcomes
proposals for a system with flexi-
bility and speed.

The new proposal, urged by
EC competition commissioner
eter Sutherlands, calls for a
ew taskforce to investigate the
competition implications of mer-
gers involving a combined turn-
over of more than Ecu 1bn.

If the turnover of the enterpri-
se to be taken over is less than
Ecu 50m, notification is not obli-
gatory. Present crossborder mer-
ger legislation has not been up-
dated since 1973 and only allows
for EEC vetting after the event.
Cefic is pleased that the propo-
sals will limit the number of ca-
ses but says questions remain,
such as what will happen in the
case of smaller mergers and ac-
quisitions. The organization will
issue a position letter soon.

The proposal has high priority
and should be adopted by the
year end.

ICI, DU PONT IN PAINTS LINK-UP

ICI is linking up with Du Pont
in an effort to become Europe's
leading supplier of automotive
coatings. The two are to merge

their European automotive paints
operations and aim to double
their 10 per cent share of the
\$900/year market within five
years.

Both ICI and Du Pont claim
that their automotive coatings
businesses have been growing
steadily and believe the marriage
of their technical and production
capabilities will enable them to
launch an assault on the market
leaders PPG, BASF and Hoechst
which control around 60 per
cent between them. The Euro-
pean automotive coatings mar-
ket is currently growing around
5 per cent/year.

The US and UK majors have
established track records in the
automotive industry and have de-
veloped products which meet
the needs of an increasingly en-
vironmentally-conscious sector.

In an effort to reduce solvent
emissions, Du Pont has pushed
high solid paints while ICI is a
leader in waterborne coatings.
This provides the merged unit
with extremely complementary-
technology.

The partners will invest \$90m
in the new company which is to
be based in Bonn, West Germa-
ny. A new production plant and
\$10m technical centre are to be
built at Bonn and the new unit
will utilize ICI's and Du Pont's
existing facilities in the UK, Bel-
gium, France and Spain.

Subject to necessary appro-
vals, the new company should be
operational within six months.
The merger agreement does not
affect the companies' non-Euro-
pean automotive businesses and
excludes vehicle refinish opera-
tions.

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Chemical Markets Abroad

VAM PRICES SOAR AS GLOBAL MARKET TIGHTENS

The global vinyl acetate monomer (VAM) market is still unsettled in the wake of the explosion and fire at the Hoechst Celanese 250,000 ton/year acetic acid plant at Pampa, Texas last November.

At the time, both US and European markets for acetic acid and VAM were tight and the sudden shortfall in acetic supply prompted downstream VAM producers to increase prices in the first half of this year. But the reasons behind the increase on either side of the Atlantic are different.

In the US, strong acetic acid demand coupled with major supply shortfalls has had a knock-on effect on derivative prices. In Europe, however, where most VAM producers are fully integrated and acetic supply has not been so critical, producers say VAM prices are being driven up by demand for end use products, particularly emulsion paints.

On the European continent, VAM prices are settling around DM1,850-1,900/ton for Q2 contracts but this, some producers believe, represents almost the peak of the market. Prices have climbed steadily from DM1,650-1,730/ton in the first quarter, but producers say further increases in Q3 will be "moderate".

"We're not negotiating prices, but quantities," said an Italian major. With little spot product available, producers are anxious not to overstretch customers. Another producer describing the market as "tight but well balanced" said "the increase is moderate compared with what we

could impose given the feedstock situation."

BP in the UK, which has two plants at Hull producing around 350,000 ton/year and a third 175,000 ton/year unit due on stream at the end of this year, said it was looking for £620/ton in April but might settle below this.

Rhone-Poulenc has its 150,000 ton/year plant at Pardies on turnaround at the moment and Hoechst's 150,000 ton/year Frankfurt plant is due for three-week maintenance in May. Producers dismiss the idea of debottlenecking or restarting mothballed VAM plants claiming that the market may "right itself" in 12 months or so after the Pampa plant comes back on stream at the end of this year.

Meanwhile, the global shortage of acetic acid feedstock has prompted ERT to start its acetic unit at Tarragona in Spain, closed since 1985. Estimated nameplate capacity there is around 90,000 ton/year although actual output is expected to be nearer 60,000 ton/year. The company claims it has sold product as far ahead as June. Spain consumes some 24,000 ton/year of acetic acid. Europe produces and consumes close to 1m ton/year, although nameplate capacity is nearer 1.13m ton/year. At the moment there is little available for purchase although traders say around 500 ton was heard on offer in Rotterdam at \$1,200/ton fob (DM1,993/ton) last week.

Since November, acetic supply in the US has gone from "tight to critical". There have been two price hikes already this year.

to 20-23 cents/pound and producers are posting 30 cents/pound for April. This is nearly double figures heard before the Pampa explosion. VAM, too, has firmed on the back of acetic acid from 24-25 cents/pound to 42-43 cent/pound fob US Gulf.

Acetic consumption in the US is estimated at around 1.4m ton/year while total production is reckoned to be in the region of 1.45m ton/year including the Pampa plant. This leaves a US acetic deficit, although an unknown factor is acetic acid supply as a co-product of polyvinyl alcohol (PVA) production — believed to be around 62,000 ton/year in the US.

To relieve temporarily the US market, Borden restarted its 68,000 ton/year acetic plant at Geismar, Louisiana, at the end of February and is selling all its product under contract to Hoechst-Celanese. In addition there are some imports of acetic to the US from Celanese Mexicana's plant in Mexico and also some material from Europe. Maintenance work is planned at several plants in the US although USI Chemicals is understood to have put back its closure until September. Another factor in the US price hikes is the rising price of ethylene, currently around 25-25.5 cents/pound.

OXYCHEM RESTARTS CHLORALKALI PLANT

Occidental Chemical Corp has restarted chloralkali production at the plant at Corpus Christi, Texas it acquired last September from Du Pont. The unit, which has been idled since July 1986, began operation on March 14.

The facility has a capacity of 415,000 ton/year of chlorine and 468,000 ton/year of caustic, and it has to Occidental's

city to 2.8m ton of chlorine and 3.1m ton of caustic. The Texas unit is producing chlorine from one of its three circuits of diaphragm cells, with the second scheduled to start up in May.

Occidental bought the unit for an estimated \$150.200m after Du Pont decided to pull out of the caustic business and buy rather than make all the chlorine-based products at its nearby fluorocarbon plant.

SAUDI PS UNIT STARTS

Petrokemya, a subsidiary of the Saudi state industrial concern Sabic, has started initial production of polystyrene at Al Jubail.

The plant, built by Japan's Chiyoda, will produce 50,000 ton/year of high impact and 30,000 ton/year of general purpose material using technology licensed from Cosden of the US and a further 20,000 ton/year of expandable product using CdF Chimie technology.

Styrene feedstock will be supplied from the Saudi Petrochemical Co (Sadaf), another Sabic affiliate in Jubail. Sabic says the "majority" of Petrokemya's PS production will be marketed domestically, with the rest directed to export markets.

The PS plant is Petrokemya's second expansion into downstream products. Last year it started up a 50,000 ton/year butene-1 unit producing monomer for three Sabic affiliates making polyethylene in the kingdom.

Meanwhile, the Saudi European Petrochemical Co (Ibn Zahar) is poised to bring its 500,000 ton/year export-oriented methyl tertiary butyl ether (MTBE) unit on stream during the second quarter of 1988.

ARCO UPS STYRENE

In response to increased demand for styrene in the US, Arco Chemical has decided to restart its idled 95,000 ton/year styrene unit at Monaca in Pennsylvania, which last operated in 1986.

Arco has also completed an expansion at its styrene plant at Channel-view, Texas, increasing capacity at the site by 50,000 ton/year to 595,000 ton/year. The expansion brings Arco's total styrene capacity, including its Nihon Oxirane joint venture in Japan, to 960,000 ton/year.

At the same time, Arco has completed an expansion of ethyl benzene production at Channel-view, increasing capacity by 160,000 ton/year to 803,000 ton/year. Arco says the increased production will not only ensure adequate feedstock supplies

but will also allow it to play the spot market.

SHELL IN MAJOR SINGAPORE PROJECTS

Shell has reaffirmed its commitment to Singapore. The company, which is trying to buy out the Singapore government's share in the Pulau Ayer Merbau petrochemical complex is investing Sin/480m (\$238.8m) in new facilities at the Shell Eastern petroleum refinery on Pulau Bukom.

The new facilities comprise a 4,000 ton/day long residue catalytic cracker, a 400 ton/day alkylation unit, a propane/propylene splitter with a capacity of 55,000 ton/year of high purity propylene, a 13 MW power recovery unit and other ancillary units.

The cat-cracker will be the first unit of its type in South East Asia.

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In the European market

Naphtha prices have firmed to \$144-145/ton cif on the back of crude, but market sentiment is weak.

Ethylene supply is tightening in Europe, with cracker closures and operating problems putting pressure on the ARG pipeline and spot product increasingly difficult to find in the Med. The Libyan cracker has a week-long closure coming up on April 6 which is likely to exacerbate the problem. Trading has been confined to NWE where one UK major sold 3,000 ton of material at \$410/ton cif NWE as part of a swap deal, but higher numbers are already being talked. Strong demand on the ARG pipeline combined with continued problems at ROW's G4 unit have

firmed spot ideas to DM880-900/ton delivered.

The **propylene** market has remained quiet with the only deep sea deal reported at DM540/ton cif for a 1,500 ton parcel leaving prices steady at DM540-560/ton.

Butadiene notional prices have remained unchanged at \$210-220/ton fob in an inactive spot market in Europe, but levels are still under pressure in the US where offers as low as 12 cents/pound have been heard. Q2 contract negotiations are opening in the range FF2,000-2,300/ton.

Benzene has drifted down to \$330-345/ton fob with little buying interest in the pre-Easter week. Two deals were concluded at \$343/ton and \$345/ton fob

Rotterdam for 1,000 ton each, but bearish sentiments around \$330/ton are now being heard. In the US, \$1.11/gallon is virtually unobtainable. However, Shell has followed Exxon by posting \$1.15/gallon for April.

With benzene numbers coming down, interest in **toluene** for HDA conversion has been weak, and spot prices have dropped accordingly to \$255-265/ton.

Reports filtered back from the NFRA suggest there is still interest in **paraxylene**, but with buyers looking for \$550/ton and sellers only willing to part with product around \$600/ton no deals have been done. In Europe notional numbers have settled between \$590-605/ton.

Orthoxylene has become a "shade firmer" this week although prices have remained in the range \$335-340/ton and \$340/ton fob Rotterdam was achieved representing the general trend of the market, traders say. A 1,000 ton parcel is available in Rotterdam at \$345/ton fob.

Styrene has held at last week's levels although no business has been done. Academic prices in the US are around 72-73 cents/pound.

Methanol is stable in dollars but T2 material has lifted to DM 305-315/ton. There is little product available reflecting T2 numbers achieved in Rotterdam of DM308/ton and DM312/ton. Exports to India are commanding \$210/ton cif. Arabian production will be curtailed by turnarounds at Sabic's 600,000 ton/year Al Jubail plant, Gulf Petrochemical Industries' 330,000 ton/year unit in Bahrain, and in Europe the 690,000 ton/year plant at Leuna is running at half its output following technical problems.

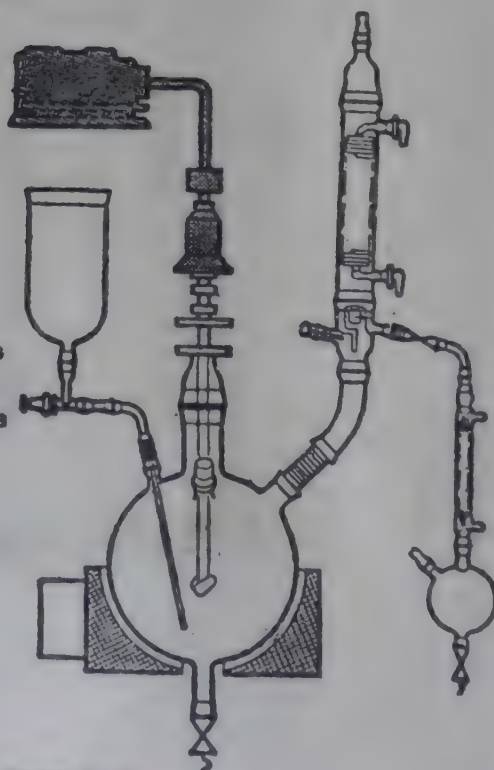
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Environment

EEC MINISTERS FAIL TO AGREE QUALITY LIMITS

Europe's council of environment ministers still cannot establish agreed water quality objectives for chromium or a proposed directive for titanium dioxide production wastes. But the council at its last meeting was at least able to agree to a directive establishing limits and quality objectives for the industrial wastes for chloroform in water.

Even though the council has been holding the commission's proposal for a titanium dioxide waste directive for many years, progress to adoption is still slow. While all members states accept that the proposal "should be adopted as soon as possible", some countries are not happy with the proposed deadlines.

France and Spain argued that it will not be possible to halt all dumping of waste by the end of 1989 while Denmark and Italy are refusing to accept that the deadline be extended to 1992. The UK is also holding up the procedure by rejecting the application of emission levels. The proposal has now been discussed at six council meetings.

The titanium dioxide directive proposal is now back with the committee of permanent representatives and it is hoped that a decision will be agreed at the June meeting of EEC ministers.

Similarly the council ministers were unable to approve a compromise formula to establish water quality objectives for chromium, proposed by council president Klaus Topfer. The major opponent was the UK as it argues that the position should be much clearer. The UK government says it is unable to accept the meas-

ure for emission standards particularly as chromium is not on its "List 1".

Nevertheless the UK did lift its reservations on a proposal for chloroform emission levels after the commission promised to come forward with proposals for containing 10 list 1 chemicals. The formal adoption of the chloroform directive will take place, without discussion in the forthcoming council, after the texts have been finalized.

SURPRISES DREDGED UP FROM THE ASHLAND SPILL

When an oil tank owned by Ashland Oil collapsed early this year near Pittsburgh, spilling diesel fuel into the Monongahela and Ohio rivers, the effects were evident over a great distance. Now, the impact may extend over a long period of time, as federal and state environmental officials investigate the possibility that volatile organic compounds (VOC) were dumped into the Ohio River following the spill.

Tests by the West Virginia Dept. of Natural Resources have detected benzene, toluene, xylene and chloroform, all substances associated with gasoline rather than diesel fuel. Tests also have found other VOC in concentrations exceeding the Environmental Protection Agency's (EPA) levels for long-term human health risk criteria.

However, "illegal dumping has not definitely been determined," says Lorraine Urbiet, spokesman for EPA Region 3 in Philadelphia. While there have been unconfirmed reports of such dumpings, no one has come forward to report an actual siting, says Peter Tennant, water quality program

me manager for the Ohio River Valley Sanitary Commission (Cincinnati).

Moreover, officials reason that the above-normal concentration of pollutants may, in fact, have been caused by the icy temperature of the river at the time of testing. When water temperature is low, Urbiet explains, VOC tend to concentrate, and the ice cover on the river could well have formed a barrier that prevented volatilization from occurring.

Investigation

The pollutants were first detected on Jan. 8 in tests conducted at the leading edge of the spill as it flowed downriver, says Urbiet, six days after the 750,000 gal of diesel oil had burst loose from the ruptured tank. A cooperative investigation involving state environmental agencies is under way.

Ashland says that no gasoline was involved in its spill. Company spokesman Roger Schrum says that the spill damaged two adjacent gasoline tanks at the Floreffe, Pa., terminal, but that the tanks were immediately drained and their entire contents recovered.

Tests found chloroform levels at 10 times the 0.19-part-per-billion (ppb) risk guideline, 1,2-dichloroethane at or above its risk level of 0.94 ppb, and 1,1,2,2-tetrachloroethane at a level exceeding its risk guideline of 0.17 ppb, according to Steven Wright, a chemist in the Div. of Water Resources at the West Virginia Dept. of Natural Resources. EPA recommends zero risk levels for carcinogens such as chloroform, Wright notes.

EPA issues maximum contaminant level limits in water for eight VOC last July. However, states have most of the enforce-

(Contd. on p. 96).

Biotechnology

TECNIMONT BUILDS YEAST PLANT

Tecnimont, Montedison's engineering arm, is to build a turn-key dry yeast production plant for the Ethiopian Sugar Corp. Costing L35bn (\$28m), the plant will have a capacity of 1,125 ton/year and will be based on Gist-brocades technology. The Dutch company's dry yeast division Vinal will undertake training of Ethiopian personnel at its plant in Casteggio, northern Italy. This facility will serve as a reference for the new project.

The plant which is to be sited 100km south of Adis Ababa, is expected to be completed in 1990.

Meanwhile, Tecnimont has teamed up with Farmitalia Carlo Erba, Erbamont's pharmaceutical company, in a 50/50 joint venture. Called Ficetec, the new concern will operate in the health and care sector, specializing in the study of pharmaceutical plants and research and development laboratories.

Parent company, Montedison, believes the venture will be successful as it combines Farmitalia's knowledge of drugs and Tecnimont's engineering capabilities. The company will carry out feasibility studies, product selection, engineering services, plant construction and training consultancy for operations.

Ficetec's chairman will be Tecnimont president and managing director Alessandrello Rosairo, and its managing director is Luigi Carlo Gastel.

BLOOD CLOT DRUG GETS GREEN LIGHT

KabiVitrum has received the green light from the Swedish health authorities for its new heparin-based clot busting drug

Fragmin. The drug has been registered for the prevention of bloodclots in connection with surgery and in conjunction with the formation of fibrin.

In addition to its effectiveness in countering thrombosis, KabiVitrum says, **Fragmin**, also reduces certain side effects associated with previous antithrombotic therapy such as raised triglyceride levels. "This will be a major step forward for patients undergoing long term treatment such as kidney dialysis," it says.

With the new drug KabiVitrum has high hopes of capturing a substantial share of the world heparin market which currently turns over about Skr2bn year/(\$350m). The drug is already registered in France, West Germany and New Zealand with further registrations expected in Western Europe later this year.

MAY & BAKER PLANS R&D EXPANSION

May & Baker, the UK subsidiary of France's Rhone-Poulenc, is planning to spend more than £12m (\$22.1m) over the next three to four years to expand and modernize research facilities for its health care division at Dagenham, UK.

More than half the investment will be spent on a new building for medicinal chemistry, which should be completed by the end of 1989, and the remaining funds will be used to modernize existing buildings.

"The building programme illustrates the group's acceptance of the UK as a leading light in terms of drug discovery. It is a real affirmation of UK credibility in this area," says Dr. John Taylor, director of pharmaceutical research and development at May & Baker.

PBI SALE CASH REMAINS UNSPENT

Plans to hand over £40m (\$73.6m), raised from the sale of the plant breeding institute to Unilever last year, to the Agricultural food research council have hit legal problems. The decision by the PBI governors to hand over the proceeds of the sale to the AFRC is being challenged by the Charity Commissioners because the PBI was registered as a charity.

The legal wrangle is expected to take some months to be resolved but, according to a department of education and science spokeswoman, will not affect UK plant science investment plans. The UK treasury is already funding a £10m expansion of laboratory facilities at the Norwich headquarters of the Institute of plant science.

(Contd. from p. 95)

ment authority for water pollution, and none has yet adopted VOC limits for rivers, says Tennant.

Urbiet says EPA will try to examine all the water quality sampling data taken at various points in the path of the spill to determine where dumping may have occurred. Initial tests detected the chemicals along a 15-mile stretch of river between Wheeling and Moundsville, W. Va.

Meanwhile, EPA and Ashland continue their efforts to clean up the diesel spill. Most of the oil slicks has now dispersed, and Ashland estimates that it retrieved about 204,000 gal of the estimated 750,000 gal spilled. The company has agreed to continue to monitor 120 miles of the river, from the spill area to Wheeling, through the spring thaw to capture any loosened pockets of fuel washing down from riverbanks.

News About New Projects

SARTOMER IN SEARCH FOR EUROPEAN POLY BD SITE

Sartomer Co of West Chester Pennsylvania, in the US has narrowed down to four its search for a European site for a new liquid polybutadiene resins facility. The contract for a detailed site survey for a plant, which is likely to cost between \$20-30m, has been awarded to John Brown's Dutch office.

John Brown was deeply involved in the development of this technology with Arco Chemical in the US and, as Crawford & Russell, constructed the company's first unit at Channelview, Texas.

Arco sold its polybutadiene business to Sartomer in 1986. These speciality resins are liquid hydroxyl-terminated low molecular weight polymers of butadiene and are used in sealants, adhesives, waterproof membranes, encapsulants, coatings and insulated window glass.

John Brown has already started an investigation of four sites — in the UK, France and two in the Netherlands — close to butadiene raw material, and will estimate the installed cost of the facility at each location. A decision on the site is due in April or early May for completion before the end of 1989.

Sartomer, the world's only producer of liquid poly BD (the company also has a joint venture with Idemitsu at Tokuyama, Japan), declined to reveal capacity figures. The company's European unit, Sartomer International, which is headquartered in the Hague, imports product from the US plant for its European customers.

In addition to poly BD, Sartomer produces acrylates and methacrylates, styrene, maleic anhydride and pigment chips for high quality printing ink.

BP CHIMIE INVESTMENT

BP Chemicals french subsidiary, BP Chimie has announced plans to invest FF200-250m (\$35-44m) in its Lavera complex in the south of France.

Outlining the investment programme, Jean Lamort, general director of BP Chimie, said that around FF75m, of the total will be spent on BP Chimie's own units and the rest on those owned by joint ventures.

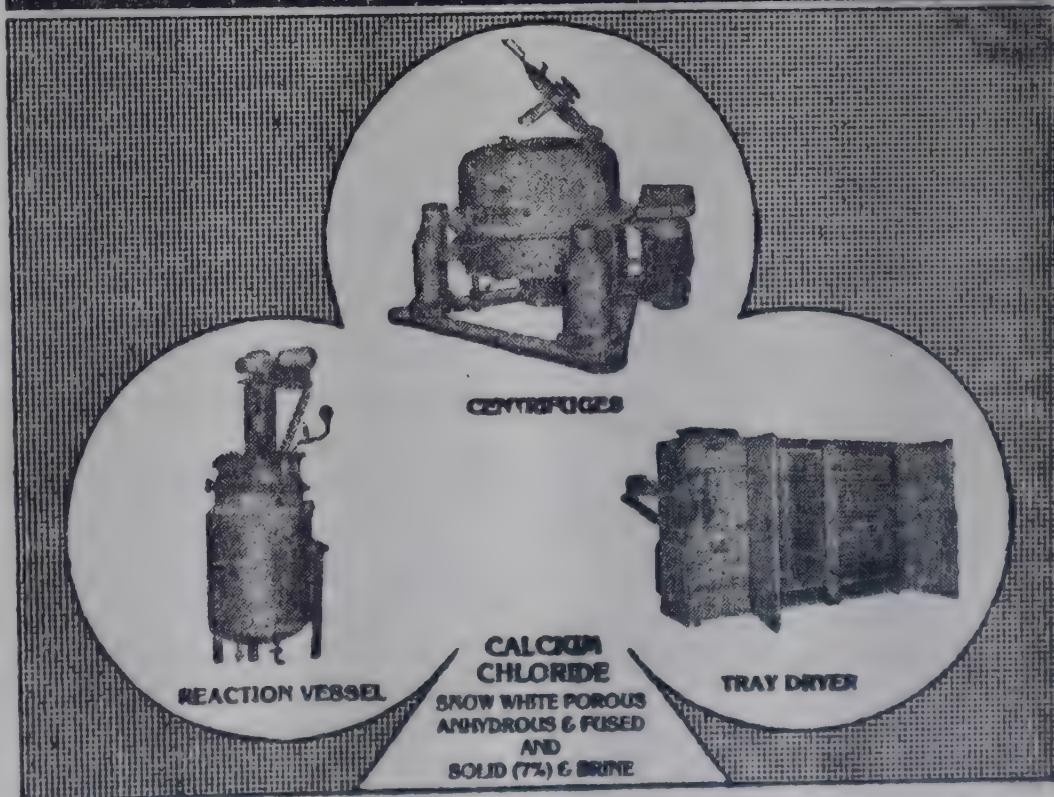
The investment programme at the complex, which last year

worked flat out, will include a debottlenecking of the ethylene plant. The 500,000 ton/year unit, the largest in France, will be expanded by at least 10 per cent.

Other plans include the debottlenecking of the new linear-to-high density polyethylene unit from 100,000 ton/year to 130,000 ton/year and of the high density polyethylene plant from 35,000 to 50,000 ton/year, ethanolamines from 16,000 to 25,000 ton/year and the expansion of the polyisobutene plant by 25 per cent or more from the original 40,000 ton/year.

New plants will include a 30,000 ton/year special acetates unit and the previously announced 150,000 ton/year polypropylene unit which is being set up

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The advertisement features three circular images of industrial equipment. The top image shows a large, complex machine with a central tank and various pipes and valves, labeled 'CENTRIFUGES'. The bottom-left image shows a vertical cylindrical tank with a smaller vessel on top, labeled 'REACTION VESSEL'. The bottom-right image shows a rectangular, box-like structure with a hinged door, labeled 'TRAY DRYER'. In the center, between the bottom two images, is text describing the product: 'CALCIUM CHLORIDE SNOW WHITE POROUS ANHYDROUS & FUSED AND SOLID (7%) & BRINE'.



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by Appryl, a joint venture with Atochem. The plant will be commissioned in August or September. High demand for PP may delay the scrapping of the existing PP plant until 1989.

The Oxochimie subsidiary, along with Atochem, is studying the conversion of the 95,000 ton/year oxo alcohols plant to the rhodium catalyst process. A basic design contract for the project has already been awarded to Davy McKee. A marginal increase in capacity is envisaged.

MALAYSIAN PLAN

A partnership between MW Kellogg and Thyssen Rheinstahl Technik has submitted a proposal to the Malaysian government to build and operate a petrochemical complex in Malaysia.

The complex would include a world-scale — around 400,000 ton/year — ethylene plant as well as polyethylene and polypropylene units. The project, which is currently being assessed, will be discussed with government officials and Petronas. The US-West German consortium could become shareholders in the venture.

A few years ago the partnership put together a package for an aromatics complex in Indonesia. This eventually went to a Japanese group.

NICAS INVESTS IN FERTILIZER UNITS

Nitratos castilla (NICAS) is replacing its nitrogen fertilizer plants at Valladolid in central Spain. Due for completion at the beginning of September this year, the project involves the construction of plants to produce 280,000 ton/year of NPK complex nitrate or 190,000 ton/year of

000 ton/year of N total). Intecsa is building the plants using the CdF Chimie process.

Owned 50 per cent by Explosivos Rio Tinto (the rest is in the hands of small shareholders) Nicas also has plants to produce 150,000 ton/year of NPK complex fertilizer and two 400 ton/day nitric acid plants.

The 80,000 ton/year ammonia requirement is purchased on the world market. The company uses the ports of Bilbao, Aviles and La Coruna in Spain and Lisbon in Portugal. Its ammonia storage capacity at the plant is 1000 ton.

Phosphate rock is purchased from Morocco at a rate of 40,000 ton/year. Most of the fertilizer output is supplied to the domestic market, although some (2,000-3,000 ton/year) is sold to France.

UCB IN UK EXPANSION

The UCB group of Belgium, a major producer of flexible packaging is doubling its UK-based bioriented polypropylene film (OPP) capacity.

Its Sidex Ltd. subsidiary's plant at Wigton will be expanded progressively to reach 26,000 ton/year capacity during 1989. The six-line plant produces both co-extruded and FVDC coated film. A new research and technical development centre in the field of OPP films is being built at Wigton for completion by the middle of 1988.

The project will give the UCB group, which is already a major producer of transparent cellulose films, a total capacity of cellulose and OPP films (Cellopp) of more than 60,000 ton/year.

A distribution centre for OPP

Belgium to cater for continental Europe.

LUMMUS WINS KOREAN CONTRACT

Lummus Crest has been awarded a contract by Yukong Ltd of South Korea to provide project management, design engineering and procurement services for polyethylene and polypropylene plants to be built in Ulsan, South Korea.

The PE unit will use the Dupont Canada Sclairtech process and the PP plant the Himont Spheripol process. Basic engineering for the PP plant will be provided by Tecnimont under a subcontract to Lummus. Both plants are due on stream in mid-1989.

TAIWAN TO RAISE POLYETHYLENE CAPACITY

Formosa Plastics Corp. and USI Far Eastern Co plan to expand polyethylene production capacity in the face of sharply rising demand. Their joint expansion should raise Taiwan's total output to 700,000 ton/year.

Formosa Plastics now has two lines at the Kaohsiung complex producing 140,000 ton/year of high density polyethylene, but says it cannot meet demand. It plans to add two more lines, boosting output to 300,000 ton/year. The company also says it will join forces with an unidentified foreign company to produce 140,000 ton/year of linear low density polyethylene.

USI announced plans for a 120,000 ton/year lldPE plant, assuming it wins government approval. The company uses Union Carbide technology for PE

News from the American Market

Chevron considers expanding styrene capacity

The race is on to increase styrene production capacity. While several styrene makers are looking at expansion possibilities Chevron Chemical's proposed project is the most ambitious to date. Chevron has approved engineering funds to study the feasibility of more than doubling capacity at its 600-million-lb/year monomer plant at St. James Parish, La., to 1.5 billion lb/year. If the project, which is expected to cost more than \$125 million, receives the go-ahead, Chevron will become one of the largest styrene producers in the U.S., according to plant manager, R. M. Dole. A final decision on whether to proceed with the expansion will be made in early 1989. During the next few months, Chevron will select contractors, compare prices, and seek permits.

Cracker shutdown puts the squeeze on ethylene

Already reeling because of drastically reduced availability, the ethylene market received a body blow last week when compressor problems prompted Amoco to bring down one of its 1.1-billion-lb/year crackers for maintenance earlier than planned. The 35 to 40 day shutdown comes at a period of peak operation for the industry, and ethylene producers say there is little or no spare capacity. Others say there is little or no spare material to make up for lost production from plant outages. Without releasing details, Exxon Chemical said last week that it is allocating shipments of ethylene to customers. Market

sources report that Exxon will limit buyers to 90% of their normal purchases in May and 80% for the remainder of the year to prepare for lengthy year-end shutdowns. Debottlenecking projects will necessitate those planned shutdowns. At least one other major ethylene producer has proposed allocating material to contract customers, sources say. Ethylene prices, meanwhile, continue to feel upward pressure. April tabs are hovering at 27 cent/lb, and there is talk of third-quarter prices of 32 cent/lb.

Price increases for May Day

Several chemical price hikes are scheduled to go into effect on May 1. The Newport Div. of Reichhold Chemicals will increase prices for polyterpene resins by 6-9 cent/lb and raise prices for terpene phenol resins by 3-5 cent/lb. Himont U.S.A. will raise the market prices for all grades of its Afax amorphous polypropylene by 3 cent/lb. Dow Chemical will boost its polypropylene glycol prices by 6 cent/lb.

Shell will make ultra-high-purity isoprene

Shell Chemical is modifying an existing plant at Deer Park, Tex., to produce ultra-high-purity isoprene.

Work on the plant, which will have capacity for 100 million lb/year, will begin in mid-1988 and should be completed in the fall of 1989. Shell uses the isoprene captively to make Kraton thermoplastic elastomers and Shelvis viscosity improvers. The plant

will purify crude isoprene streams produced in Shell's olefins' network. Two other products piperylene and dicyclopentadiene, used in tackifying resins for adhesives and in injection-molding resins, will also be produced at the unit.

Carbide plans an n-butanol capacity addition

Union Carbide will increase n-butanol capacity by 160 million lb/year, to 560 million lb/year, at Texas City, Tex., by the end of 1989. Upon completion of the expansion, the plant's capacity for producing butyraldehyde, the principal precursor of n-butanol, will be 800 million lb/year. "Butanol is a key to maintaining our leading position in the coatings market as a supplier of acrylates, glycol ethers and acetic esters," comments Nathan L. Zutty, president of Carbide's Solvents and Coatings Materials Div.

Carbide's polypropylene unit has smooth start up

The second polypropylene plant using the Unipol process developed by Union Carbide and Shell Chemical has had a smooth startup at Yocheon, South Korea. The Korean licensee, Honam Oil Refinery, has been operating the unit for the past two months, and, so far, has produced five grades of homopolymer, according to C.N. Son, the plant's manager. Construction of the plant was completed in seven months, he says, noting that "polymerization reaction began 20 minutes after catalyst injection, and we could raise production to design values within two hours." The other plant using the process is operated by Carbide at Seadrift, Tex.

New Developments from America

Real R & D spending rises — slowly

In a recent study, the National Science Foundation (NSF) estimates that U.S. spending for research and development (R&D) will reach \$132 billion in 1988, or 7% more than the estimated spending for 1987. But after adjusting for expected inflation, the rise represents an increase of only 3%, the lowest rate of real R&D growth since 1977. For example, between 1977 and 1982, national R&D expenditures grew by 4.5%/year in real dollars, and between 1982 and 1985 real R&D growth increased by 6.8%/year, before slowing to 4% in both 1986 and 1987, says NSF. The foundation says it expects that about 68% of the nation's total R&D expenditures will be for development activities in 1988; that fraction has increased gradually from a level of 64% in 1982, primarily, says NSF, because of major increases in federal spending on defense R&D activities with their heavy developmental component. One yardstick of R&D activity that has remained stable is the proportion of U.S. gross national product (GNP) spent on R&D: approximately 2.7% between 1985 and 1988. NSF predicts that the U.S. spending as a percentage of GNP will continue to exceed or approximate that of other market-oriented, industrialized nations. If nondefense R&D expenditures are compared with the GNP, the U.S. percentage is substantially lower; it has stood at 1.8% for the past five years. In contrast civilian R&D spending as a percentage of GNP in Japan was 2.8% in 1985 and 2.7% in West Germany in 1986.

Working to develop in vitro allergy tests

The Johns Hopkins School of Public Health (Baltimore) is trying to develop a way to do allergy testing for such products as cosmetics, pharmaceuticals and industrial chemicals without using animals. Avon Products is providing \$300,000 for the project. One method that Avon currently uses to avoid unnecessary animal skin tests involves a computer comparison of new products with previous ones that already have been tested. If the formulation of the new product is similar to that of a product that has already been proved safe by animal tests, Avon believes, no further testing is necessary. "Over the years we've tested thousands of formulations," says Yale Gressel, director of product safety and integrity at Avon. "In the past we did some redundant testing. Now that has been eliminated."

An antibiotic that fights gum disease

Scientists at Tel Aviv University (Israel) are testing a new antibiotic as an agent to fight periodontal disease. Antibiotic TA, made from the myxobacteria *Myxococcus xanthus*, has already been found to be "effective against gingivitis and dental plaque," says a university spokesman. Plaque is associated with gingivitis (gum swelling and bleeding), which in turn can lead to periodontitis, or destruction of tissues that support the teeth. The university spokesman says that the antibiotic binds "tightly" to tooth surfaces and could be applied as a liquid or semiliquid.

A lead-free solder for water pipes

The Safe Drinking Water Act amendments, which were enacted in 1986 and go into effect this June, include a regulation limiting the lead content of pipes, solder and flux used in drinking water systems. Solder and flux must contain less than 0.2% lead. Engelhard (Edison, N.J.) has come up with a lead-free solder, called Silvabrite 100, made of 95.5% tin, 4% copper and 0.5% silver. Impurities — including lead — make up less than 0.5% of the solder. The company maintains that the solder, which melts at 440 F, is stronger and more corrosion-resistant than lead-containing solders. It also is "significantly easier" to work with than conventional lead-free solders made of tin and antimony, because of its low melting point and wide working range, adds Al T. Lubrano, business director of Engelhard's Metal Joining unit.

Small synthetic blood vessels enter human trials

Research Industries (Salt Lake City), a \$6 million/year maker of specialty medical and drug products, has purchased assets and patented technology (U.S. 4,173,689) from Vascular International to develop and manufacture a proprietary copolyurethane blood vessel. The U.S. Food and Drug Administration has given Research Industries the green light to begin peripheral, or lower-leg, human testing of the synthetic vascular graft. Polyester and Gortex, a polytetrafluoroethylene microporous membrane material, are used for larger vessels, but they can lead to clotting in smaller vessels. The urethane is said to be the first synthetic replacement for vessels less than 7 mm in diameter.

MARKET INFORMATION

Styrene becomes dearer

Gohsenol & Styrene prices went up by Rs. 8 and Rs. 3 per kg. due to non availability of ready supplies. Gohsenol was now quoted around Rs 95 per kg and styrene around Rs. 44 per kg.

Manufacturers raised prices of amines — mono, di & tri by Rs. 2.

Intermediate prices continued to be steady with the exception of Tobias acid which went up Rs. 3 to Rs. 116 per kg.

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent — and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

The Dyes market also remained steady with no significant change in the prices.

(Prices as on 12th May 1988)

INDUSTRIAL CHEMICALS	Per kg.				
Ammonium sulphate	2.00	Borax (Granular)	15.00	Calcium Carbonate PPT	3.00
Ammonium phosphate (Mono)	14.50	Borax (Powder)	15.50	Calcium carbonate (Activated)	3.55
Ammonium phosphate (Di)	12.00	Boric acid (Tech.)	21.00	Camphor (Indian)	82.00
Ammonium carbonate (Di)	17.00	Bisphenol-A	45.75+ST	Cresylic acid	50.00
Ammonium bicarbonate	4.75	Butyl carbitol	35.00	Cream of Tartar (Tech.)	64.00
Ammonium chloride	3.00	Caustic soda (Flakes)	8.00	Citric acid (Belgium) (Resale)	44.00
Ammonium nitrate	3.50	Caustic soda (Solid)	7.60	Citric acid (Indian) (Resale)	43.00
Arsenic white powder	21.00	Caustic soda (Lye)	6.00	Copper sulphate	17.50
Acrylamide (Resale)	58.00	Calcium chloride 70% (solid)	3.25	Chromic acid	50.00
Barium carbonate	6.00	Calcium chloride 75-80% (fused)	3.50	Cyanuric chloride	120.00
Bleaching powder (33% Cl)	3.80	Calcium chloride 36% (Anhydrous)	5.00	Cobalt oxide	280.00
				Carbitol	50.50+ST



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Ferric Chloride (Lumps) 7.00	Sodium sulphate (Coarse) 5.00	Butyl stearate (Resale) 34.00
Ethylene urea 56.00	Sodium sulphide 50-52% (Flakes) 8.00	Butanol 24.00
Glue flakes 8.45	Sodium sulphide 58-60% (Flakes) (TCL) 21.00	Benzyl chloride 16.00
Glue sheets 6.75	Sodium sulphide pure (Flakes) 12.25	Benzo trichloride 22.00
Gohsenol GH-17 95+ST	Sodium nitrite (Resale) 16.00	Benzoyl chloride 42.50
Hydro (Resale) 38.00	Sodium chlorite 80% (Spain) 92.00	Bromine Liquid 24.50
Hyflosupercell 20+ST	Sodium chloride 50% (Spain) 81.00	Chloroform 13.00
Hexamine (Resale) 35.00	Santobrite (Indian) 36.00	Carbon Tetrachloride 44+ST
Industrial Wax 25.00	Soda Ash (Tata) 4.00	Cellosolve 47+ST
Litharge 15.00	Soda Ash (Birla) 3.80	Cyclohexanone 43.00
Lead Acetate (Tech.) 28.50	Soda Ash (Imp.) 3.50	Cyclohexanol (Resale) 35.00
Lithopone 15+ST	Sodium bicarbonate 5.25	Diacetone 34.00
Magnesium chloride (crystal) 1.80	Sodium bisulphite 4.50	Diethyl Oxalate 36.00
Menthol crystal (Flakes) 185+Ex.+ST	Sodium silicate 3.00	Diethylene glycol (DEG) 52.00
Menthol bold 205+Ex.+ST	Sodium acetate 6.00	Diethyl Phthalate 56.00
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Magnesium carbonate (Japan) 16.00	Titanium Dioxide (Anatase) 50+ST	Dimethyl Phthalate 52.00
Magnesium carbonate (Indian) 15.00	Titanium Dioxide (Putile — RCR ₂) 69+ST	Diethyl Adipate 42.00
Maleic Anhydride (per kg) (Resale) 45.00	Tartaric acid (Crystal) 94.00	Dibutyl Adipate 15.00
Mercury (75 lbs.) 9,000.00	Trisodium phosphate 4.80	Dipentene 12.00
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Potassium phosphate (Di) 14.00	SOLVENTS Per kg.	Formaldehyde 50.00
Polyvinyl alcohol (No. 117) 88.00	Acetic Acid (Glacial) (Resale) 13.35	Glycerine (CP) 49.00
Polyvinyl alcohol (No. 173) (Resale) 94.00	Acetic Anhydride (Resale) 30.00	Glycerine (IW) (Resale) 29.00
Polyvinyl alcohol (No. 208) 78.50+ST	Acetone (Resale) 15.00	Hydrogen peroxide 50% (Resale) 29.00
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STABLE BLEACHING POWDER (AVAILABLE CHLORINE 35% TO 38%)

VIKRAM BRAND

Packed In 25 Kgs and 50 Kgs HDPE Bags and 50 Kgs M.S. & G. I. Drums

Contact Manufacturers :

GRASIM INDUSTRIES LTD.

(FORMERLY GWALIOR RAYON)

91, Sakhar Bhawan, 230, Nariman Point, BOMBAY-400 021.

Phone : 2043454

Telex : 011-4235 GRIR IN

Delhi Marketing Office: 309, World Trade Centre, 1, Barakhamba Lane,
New Delhi-110 001.

Tel: 3311472/3319596

Telex: 31-62837

The most reliable source for quality chemicals.

SBP

VIKRAM
BRAND

ISI

Milestone Industries

1013-14, Phase-IV G.I.D.C. Estate, Naroda 382 330
Phone : 810560, 812543. Gram : Mileston

milestone

IRON POWDER

(REDUCTION GRADE)

milestone



Bombay Dyes Market

(Prices as on 12th May 1988)

ACID COLOUR	Per Kg				
Acid Violet 4BS	143.00	Red	96.90	Red D2B Powder	477.40
Acid Maroon V	110.00	Dark Tan	78.25	Violet C 4R	521.90
Acid Orange II	77.80	Red IIR	72.55	Blue BG Powder	235.45
Acid Orange IIV	63.05	Red 4B	169.10	Blue BN Powder	103.75
Acid Red A	107.25	Bordeaux BW	132.30	Blue D 2R Powder	476.25
Crosein Scarlet MOG	155.00	Fast Scarlet 4BS	166.55	Navy BT Powder	243.90
Acid Scarlet 3R	99.90	Red 12B	170.55	Blue B 2G Powder	210.20
Acid Red 38N	135.00	Bordeaux Hly Conc.	194.00	Black BT Powder	182.60
Acid Red R2R	132.00	Cotton Red N	117.05	Blue BR Powder	390.20
Acid Red RS	88.00	Brill. Fast Helio B	278.00	Yellow 7GL	338.60
Acid Green V	230.00	Brill. Fast Helio 2B	297.00	Yellow 5RX	218.80
Acid Patent Blue AS	250.00	Brill. Fast Helio 2RS	136.20	Yellow 3G	367.25
Acid Coomasi Blue	200.00	Brill. Fast Helio BS	116.10	Yellow	140.00
Acid Yellow 5GN	65.00	Brill. Violet Extra	126.40	Yellow AL	135.30
Acid Red PG	85.00	Blue 2B	86.40	Yellow Brown REL	247.50
Acid Red GRS	78.00	Blue G	170.50	Yellow FFL	463.60
Acid Black 10 BX	121.95	Sky Blue FB	188.25	Gold Yellow GG	259.70
Acid Black BX	98.40	Copper Blue GR	147.00	Pink REL	247.00
Acid Black Wax	135.50	Fast Greenish Blue GL	114.60	Red REL	468.65
Procinil Yellow GS (ICI, UK)	265.00	Developed Black BT	116.10	Red 2B	327.40
Procinil Red GS (ICI, UK)	630.00	Blue NB-2B	300.20	Red FB	324.20
Procinil Blue RS (ICI, UK)	315.00	Blue NB-2BC	185.30	Red Violet FBL	469.85
Procinil Scarlet G (ICI, UK)	600.00	Developed Black NB-GHB	185.30	Orange 3R	196.65
Procinil Orange G (ICI, UK)	250.00	Green B	111.65	Violet 3R	280.00
Procinil Rubine (ICI, UK)	650.00	Green NB-B	188.25	Violet RL	275.45
		Green 2B-N	188.25	Violet 6R	485.75
		Brown MR	154.40	Scarlet RR	214.85
		Brown CN	107.25	Rubine 3B	223.05
		Golden Brown G	140.35	Rubine CB	364.90
		Catechin G	120.50	Blue GL	318.95
		Omega Tan	126.40	Blue BGF	638.55
		Catechin GS	102.80	Navy Blue RF	270.40
		Black E Hly Conc.	142.60	Brown 3REL	200.40
		Black E Extra Hly Conc.	142.60	Black GEL	324.20
		Black NB-ER Hly. Conc.	310.50	Dark Brown 3B	317.40
		DISPERSOL COLOURS	Per Kg	BASE COLOURS	Per Kg
Yellow 3GX	88.10	Yellow 6G Powder	143.80	Fast Yellow	80.20
Gun Yellow RCH	124.00	Red B 3B Powder	247.80	Fast Orange GC	135.45
Fast Yellow GCH	141.15	Red B 2B Powder	323.20	Fast Scarlet R	166.90
Yellow CFG Hly. Conc.	312.00	Red CB Powder	439.15	Fast Scarlet RC	126.65
Fast Yellow GS	111.65				
Fast Yellow CHRS	95.45				
Viscose Orange	166.15				
Fast Orange GR	133.75				

Fast Scarlet RCR	99.05	Navy Blue H 3R	298.50	Blue RR Supra Powder	629.35
Fast Scarlet G	121.65	Brill. Blue H-GR	366.55	Blue Conc. Powder	645.80
Fast Scarlet GN	91.50	Brill. Blue H 5G	173.10	Brill. Blue 2R Hly. Conc.	378.55
Fast Scarlet GG	72.70	Blue H 5R	283.85	Brill. Blue 2R Supra Disp.	115.65
Fast Scarlet GGS	72.75	Brill. Blue H 7G	178.70	Dark Blue 2R Powder Fine	389.25
Fast Red B	203.20	Brill. Blue H 7RX	358.15	Blue BC Supra Disp.	359.40
Fast Red RC	119.15	Turquoise HA	234.45	Jade Green XBN Powder Fine	438.20
Fast Red R Flakes	149.25	Supra Blue H-3RP	335.70	Jade Green XBN Acra	
Fast Red TR	166.80	Supra Turquoise H 2GF	181.50	Conc. Powder	823.90
Fast Red TR Oil	183.15	Blue H 5RX	269.30	Jade Green 2G Pdr. Fine	419.65
Fast Red RL	237.10	Navy Blue H ER	258.50	Jade Green 2G Ptg. Paste	125.40
Fast Red KB Oil	201.90	Blue H-ERD	305.80	Jade Green XBN Ptg. Paste	126.00
Fast Bordeaux GP	201.95	Navy Blue M 3R	310.95	Jade Green 2G Supra Disp.	496.00
Fast Garnet GBC	94.05	Brill. Blue MR	331.70	Olive Green B Pdr. Fine	399.90
Fast Violet B	605.60	Brill. Blue M RX	214.20	Olive D Pdr. Fine	444.30
Fast Blue BB	521.45	Brill. Blue M-G	382.30	Olive Green B Supra Disp.	308.25
NAPHTHOL COLOURS		Blue M 4GD	344.60	Jade Green XBN Supra	
	Per Kg	Navy Blue M RB	318.75	Disp. (N)	327.30
ASG	217.00	Turquoise M-G	197.85	Olive OMW Pdr. Fine	698.55
AS	143.00	Brill. Blue M GX	302.50	Olive OMW Supra Disp.	538.05
ASSW	279.75	Blue 3R Acra Powder	718.20	Olive R. Pdr. Fine	422.95
ABBS	189.15	Dark Brown H 6R	248.45	Olive R. Pdr. Fine	422.95
ASBO	195.65	Cobalt Oxide (per kg)	285.00	Olive D Supra Disp.	361.70
ASD	175.50	Green H 4BD	269.80	Olive R supra Disp.	363.90
ASOL	179.35	Green H-E4B	169.80	Olive D. Ptg. Paste	193.00
ASTR	279.75	Red Brown H IF	143.25	Olive Green B. Ptg. Paste	199.10
ASPH	279.75	Orange Brown H 28	209.05	Olive Green B Acra Conc.	542.75
ASE	196.05	Brown M GRN	188.60	Olive R Acra Conc.	640.00
ASEI	184.40	Black H-N	283.35	Olive Green B Acra Conc.	542.75
ASLB	1632.60	SULFUR COLOURS		Brown R Pdr. Fine	835.00
ASBT	1817.00		Per Kg	Brown G. Pdr. Fine	795.00
ASWG	143.00	Navy Blue	99.85	Brown R Pdr. Fine	659.75
ASSG	397.70	Green G	105.55	Dark Brown 3R Pdr. Fine	685.00
ASSR	480.50	Black Grains Extra	63.05	Brown G. Supra Disp.	449.90
PROCION COLOURS		Black Grains OG	64.55	Brown 2G Supra Disp.	554.00
	Per Kg	Black GXE Conc.	61.60	Brown R Supra Disp.	422.95
Golden Yellow HR	181.80	Black GXE	52.75	Brown BR Powder	719.00
Brill. Yellow H4G	117.85	Black GXR	61.60	Dark Brown 3R Ptg. Paste	217.15
Supra Yellow H-8GP	168.55	Black Grains 800	54.20	Dark Brown 3R Supra Disp.	414.55
Brill. Yellow HE6G	166.95	Black EXR Grains	64.55	Brown G Acra Conc.	733.95
Yellow H-E4R	276.05	Black EXR Grains 800	51.25	Brown R Acra Conc.	766.00
Brill. Yellow H7G	332.30	VAT COLOURS (ICI)		Grey M. Powder Fine	768.80
Yellow M4R	243.95		Per Kg	Grey M. Supra Disp.	585.45
Yellow M GR	326.05	Yellow 5G Powder Fine	673.15	Blue BC Acra Conc. Pdr. Fine	762.70
Brill. Yellow M4G	177.10	Yellow 5G Supra Disperse	439.30	Direct Black AC Supra Disp.	330.35
Brill. Yellow M8G	332.30	Yellow 5G Acra Conc.	628.75	Direct Black AC Pdr. Fine	474.70
Yellow M 3R	217.60	Yellow 3R Powder	588.85	Direct Black CH Supra Disp.	393.20
Brill. Orange H 2R	241.85	Gold Orange 3G Pdr. Fine	952.15	Direct ACD Ptg. Paste	217.15
Brill. Red H 7B	157.95	Brill. Orange 6R Pdr. Fine	624.35		
Brill. Orange M 2R	313.15	Gold Orange 3G Supra Disp.	601.30		
Brill. Red H 85	169.45	Brill. Orange 6RX Powder	394.30		
Brill. Scarlet H RN	245.05	Brill. Red 3B Pdr. Fine	997.80		
Supra Red H-3BP	179.30	Brill. Red 3B Supra Disp.	713.20		
Brill. Red H-F3B	243.45	Brill. Purple 4R Conc. Pdr.	470.75		
Brill. Magenta H8	167.00	Brill. Purple 3R Acra Powder	690.85		
Brill. Red M. 5B	98.90	Brill. Purple 2R Hly Conc.	597.90		
Brill. Red M 8B	173.70	Brill. Purple 4R Supra Disp.	500.05		
Brill. Pink MB	137.10	Brill. Purple 2R Acra Conc.	625.95		
Brill. Magenta MB	121.55	Blue R Powder Fine	542.15		
Brill. Purple H-3R	180.20	Blue BC Conc. Pdr. Fine	522.50		
Brill. Purple H-7R	175.40	Blue BC Acra Conc. Pdr. Fine	762.70		
		Blue R Conc. Pdr. Fine	577.65		

Delhi Market

DELHI: MAY 13 (NNS) — A sharp rise of Rs. 700 per flask in mercury provided the main feature of trading in the Delhi Chemicals Market during past week, reports NNS. Carbon Tetrachloride and chloroform also looked up by Rs. 1.50/2 (per kg), while Hydrogen peroxide, formic acid and titanium dioxide softened slightly in the wake of sluggish offtake. Turnover was moderate.

Mercury recorded a handsome gain of Rs. 700 and touched a new peak of Rs. 10,500 per flask due to acute shortage of stock alongwith higher Bombay advices, where mercury advanced from Rs. 10,000 to Rs. 10,500 per flask. Its prices may increase in near future caused by tight supply by MMTC. Sodium hydro sulphite Damo sha and Tamil Nadu hardened further by 50 paise at Rs. 35 each per kg. Chatkolite, however slipped by Re. 1 at Rs. 48 due to poor buying by Gurrhandsari manufacturers. Rangolite (Germany) dropped by Rs. 5 at Rs. 65 in the absence of enquiries.

Citric acid small dana, slipped further by Rs. 50 at Rs. 2050 owing to poor offtake. Tartaric acid France quality declined sharply by Rs. 50 at Rs. 6800 on poor demand and improved supply. Paraffin wax eased by Rs. 5 at Rs. 595 (per kg) on scattered selling.

Sodium nitrite nose-dived further by Rs. 50 at Rs. 800/825 on stockists selling. Sodium nitrate also ruled dull at Rs. 400/425.

Titanium dioxide Anatase dropped by Rs. 1.50 at Rs. 48.50 in the absence of demand by paint and plastic units. RC-822 too eased by Re. 1 at Rs. 63. Formic acid and Hydrogen peroxide slipped from Rs. 28 and Rs. 30 to Rs. 26.50 and Rs. 29 (per kg).

Menthol medium and bold drifted lower by Rs. 2 at Rs. 170 and Rs. 180 (per kg) respectively owing to hesitant selling by stockists in hope of arrivals of new crop mentha from U.P. within a few days. Menthol flake, on the other hand, rose by Rs. 2 at Rs. 164 on tight stock position. Mentha oil gained from Rs. 125 to Rs. 130 while DMO ruled easy at Rs. 65 (per kg).

Borax crystal marked up by Rs. 25 at Rs. 600 on tight supply. Borax granular too followed suit and recovered by Rs. 5 at Rs. 575. Sodium Bichromate looked up by Rs. 25 at Rs. 1050/1150. Trisodium phosphate increased by Rs. 10 at Rs. 360 while inferior quality was sold at Rs. 325 against Rs. 340.

Dyes and colours hovered around at their previous levels.

(DELHI MARKET RATES AS ON MAY 13, 1988)

Ammonia Bicarb (per 25 kg)	118.00
Mercury (per flask)	10,500.00
Soda ash (per bag)	270-295.00
Ammonium chloride (per 50 kg)	115-180.00
Caustic soda solid	No Stock
Caustic soda flakes (per 50 kg.)	400-405.00
Citric acid (per 50 kg)	2050-2400.00
Stable Bleaching Powder Shriram (per 25 kg)	95.00
Stable Bleaching Powder KCl (per 25 kg)	85.00
Stable Bleaching Powder MODI (per 25 kg.)	90.00
Sod. Bicarbonate (per 50 kg)	255-275.00
Sod. Hydro Sulphite (per kg)	35-37.00
Rangolite (per kg)	48-65.00

Boric acid Technical (per 50 kg)	980.00
Paraffin wax (per 50 kg)	595.00
Tartaric acid (per 50 kg)	6,800.00
Borax Granular (per 50 kg)	575.00
Borax Crystal (per 50 kg)	600.00
Sodium Nitrate (per 50 kg)	400-425.00
Sodium Nitrite (per 50 kg)	800-825.00
Camphor Powder (per kg)	86.00
Camphor Thal (per kg)	97.00
Menthol Medium (per kg)	170.00
Menthol Flakes (per kg)	164.00
Menthol Bold (per kg)	182.00
Glycerine (per kg)	42-43.00
Sodium Silicate (per quintal)	200-250.00
Hexamine (per kg)	42.00
Acetic Acid Glacial (per kg)	13-13.50
Copper Sulphate (per quintal)	1800-2100.00

Formic acid (per kg)	26.50
Formaldehyde (per kg)	8.00
Hydrogen Peroxide (per kg)	29.00
Calcium Carbonate (per tonne)	2500-4000.00
Acid Slurry Soft (per kg)	22.00
Acid Slurry Hard (per kg)	30.00
Phosphoric Acid (per 50 kg)	825.00
Pot. Nitrate (per quintal)	900-1200.00
Pot. Permanganate (per 50 kg)	2300.00
Sod. Bichromate (per 50 kg)	1050-1750.00
Tri-Sod. Phosphate (per 50 kg)	325-360.00
Titanium Dioxide Anatase (per kg)	48.50
Titanium RC-822 (per kg)	63.00
Zinc Oxide (per mt)	3500-4000.00
Phenol Carbolic Acid (per kg)	33.00
Carbon Tetrachloride (per kg)	19.00
Chloroform (per kg)	28.00
Sodium Sulphate (per 50 kg)	170.00
Naphthalene Balls (per 50 kg)	1400.00

DYES & COLOURS per kg

Naphthol AS	150.00
Naphthol ASG	235.00
Naphthol ASBS	200.00
Naphthol ASTR	302.00
Naphthol ASOL	191.00
Naphthol ASBO	208.00

DIRECT DYES (per kg)

Black E. Conc.	92-155.00
Diazo Black B.T.	125.00
Green B.	119.00
Blue 2-B	86.00
Sky Blue FB	200.15
Basic Auramine O' Conc.	55-100.00
Basic Rohdamine B. 500%	220-320.00
Basic Methylene Blue	92-130.00
Basic Violet	142-160.00
Basic Malachite Green	160-185.00
Acid Orange	45-52.00

Madras Market

There has been a spurt in the prices of Tri sodium phosphate due to poor availability of the material from IRE. Acetone prices have been slashed due to heavy discounts offered by manufacturers who are required to keep their production of phenol at high levels to meet export commitments thereby disposing the co-product ace-

tone at lower prices. Methanol availability is improving with the commencement of production by Rama Petrochemicals Ltd. Ethyl Acetate prices have softened due to poor off-take by pharmaceutical consumers. Benzene continues to be in short supply. Prices of industrial chemicals have mostly remained unchanged.

(MADRAS MARKET RATES AS ON MAY 14, 1988)

Sodium Nitrite (per 50 kg)	660.00
Sodium Nitrate (per 50 kg)	425.00
Sodium Silicate (per tonne)	4000.00
Sodium Sulphate (per tonne)	3500.00

Sodium Sulphide Flakes (per tonne)	13,000.00
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Sodium Bi-sulphite (per 50 kg.)	180.00
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Stearic Acid (per kg)	32.00
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Trisodium phosphate (per 50 kg)	385.00
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Titanium Di-oxide Indian TTP (per kg)	52.00
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Titanium Di-oxide Indian Rutile (per kg)	62.00
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Urea Tech (per tonne)	2800.00
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Zinc Oxide (per kg.)	34.00
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Zinc Chloride Powder (per kg.)	13.00
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Zinc Sulphate (per tonne)	4000.00
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Di-octyl phthalate (per kg.)	47.00
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Di-butyl phthalate (per kg.)	47.00
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Hexamine (per kg)	28.00
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SOLVENTS

Acetone (H.O.C.) (per kg)	16.25
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Isopropyl Alcohol NOCIL (per kg.)	21.50
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Diacetone Alcohol NOCIL (per kg)	26.50
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Benzene SAIL (per l.g)	14.00
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Diethylene Glycol NOCIL (per kg)	33.00
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Butanol NOCIL (per kg)	34.00
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Toluene SAIL (per litre)	14.00
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Xylene IPCL (per litre)	13.00
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Phenol HOC (per kg.)	26.00
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Turpentine (per litre)	13.50
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Sorbitol (per kg.)	30.00
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Trichloroethylene MCIC (per kg)	23.50
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Carbon Tetra Chloride (per kg)	15.50
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Chloroform (per kg)	24.50
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Methylene chloride (per kg)	23.50
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Methyl Ethyl Ketone (per kg.)	42.00
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Cellosolve (per kg)	48.00
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Triethanolamine (per kg)	23.50
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Ethyl Acetate (per kg.)	22.00
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Butyl Acetate (per kg)	38.00
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Methanol (per litre)	10.00
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Acetic Acid — Glacial (per kg)	17.00
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Acid Slurry (Soft) (per kg)	28.00
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Aluminium Sulphate Iron free (per tonne)	1,700.00
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Ammonium Bi-carbonate (per 25 kg.)	120.00
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Ammonium Chloride SPIC (per tonne)	1800.00
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Bleaching Powder — Mettur (per 25 kgs. bags)	125.00
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Borax Granular	640.00
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Cresylic Acid 100% (per kg)	85+E.D
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Meta Cresol 40/42% (per kg)	39+E.D
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Para Cresol 80/85% (per ton)	60+E.D
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Caustic Soda Flakes (Mettur) (per ton)	8,400.00
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Caustic Soda Flakes (Andhra Sugar)	8,400.00
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Citric Acid — Indian (per kg)	46.00
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Copper Sulphate (per 50 kg.)	1000.00
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Formic Acid (India) (per kg)	27.00
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Formaldehyde (per kg)	8.00
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Glycerine (per kg)	42.00
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Hydrosulphite of Soda TCPL (per kg)	32.00
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Hydrosulphite of Soda IDI (per kg)	36.00
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Hydrosulphite of Soda BASF (per kg.)	38.00
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Hydrogen Peroxide (India) (per kg.)	35.00
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Hyflo Supercell	19.00
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Magnesium Carbonate Light	18.00
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Potassium Bichromate (per kg)	26.00
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Phosphoric Acid (per kg)	18.00
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Phthalic Anhydride (per kg)	25.00
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Pentaerythritol (per kg)	52.00
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Paraffin Wax (per kg)	13.50
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Oxalic Acid (per kg.)	20.00
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Soda Ash (TAC) (per 75 kg)	325.00
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Soda Ash (TATA) (per 75 kg)	325.00
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Sodium Cyanide Indian (per kg.)	47.00
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Sodium Cyanide Degussa (per kg)	70.00
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Sodium Bichromate (per kg)	19.00
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Sodium Bicarbonate (per 50 kg)	280.00
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MATERIALS IMPORTED

BOMBAY

(Cost of Imported Item is
CIF Value)

(From 20-1-88 to 21-1-88)

✓ ACETIC ANHYDRIDE MIN.
98%: From FRG: Triochem Pro-
ducts Ltd., 30,400 kgs., Rs.
2,99,965.

ACETYLAMINO 3N (2 CYA-
NOETHYL) 3N (2-HYDROXY-
ETHYL) AMINO BENZENE: From
Switzerland: Sandoz (India) Ltd.,
3,180 kgs., Rs. 9,01,818.

ACRYLAMIDE: From Japan:
Shri Radha Krishna Dychem P.
Ltd., 1,020 kgs., Rs. 21,851.

ALDEHYDE C-11: From Swit-
zerland: Naarden India Ltd., 25
kgs., Rs. 16,607.

ALDEHYDE C-16 100%: From
Switzerland: Naarden India Ltd.,
50 kgs., Rs. 1,434.

ALKYL BENZENE (HARD):
From Taiwan: Doshi & Sons,
7,000 kgs., Rs. 71,825.

ALLYL CYCLOHEXYL PROPI-
ONATE: From Switzerland: Pio-
ma Industries, 25 kgs., Rs. 14-
845.

ALPHA NAPHTHOL: From Is-
rael: Resins and Allied Inds.
(Bomb.) P. Ltd., 2,000 kgs., Rs.
1,15,863.

D-ALPHA PHENYL GLYC-
INE CHLORIDE HYDROCHLOR-
IDE: From Spain: Alembic Che-
mical Works Co. Ltd., 1,015 kgs,
Rs. 3,23,124.

AMINO ANISIC ACID ANILI-
DE: From Japan: Sudarshan
Chemical Industries, 200 kgs.,
Rs. 75,721.

AMINO BENZOIC ACID SUL-
PHAMIDE 2,1,5: From FRG: In-

dian Dyestuff Inds. Ltd., 2,475
mts., Rs. 12,09,978.

1 - AMINO - 2 - BROMO - 4 -
HYDROXY - ANTHRAQUINONE:
From FRG: Colour Chem Ltd.,
600 kgs., Rs. 3,05,550.

O - AMINOPHENYL O - CRES-
YL ETHER: From France: Progres-
sive Dyestuffs, 500 kgs., Rs. 88,-
247.

AMINO PYRIDINE: From Swit-
zerland: Wockhardt Ltd., 220
kgs., Rs. 50,325.

✓ AROMATIC CHEMICALS :
From USA: 860 kgs., Rs. 25,-
346.

ARSENIC TRIOXIDE: From
Phillipines: Iberia Organics Pvt.
Ltd., 60,000 kgs., Rs. 4,06,992.

BENZYL ISOEUGENOL: From
Netherlands: S. H. Kelkar & Co.
Ltd., 10 kgs., Rs. 8,972.

BIS (3-METHYL - 4 - AMINO
PHENYL) METHANE: From FRG:
Dr. Beck & Co. Ltd., 500 kgs.,
Rs. 80,257.

BISPHENOL-A: From Brazil:
Cibatul Ltd., 1,00,000 kgs., Rs.
15,73,156.

BORON CARBIDE POWDER
(GRIT 250): From FRG: Sandvik
Asia Ltd., 200 kgs., Rs. 86,368.

BORON CARBIDE POWDER
(GRIT 400): From FRG: Sandvik
Asia Ltd., 150 kgs., Rs. 1,14,-
886.

N-BUTANOL: From FRG: Asha
Nitro Cellulose Pvt. Ltd., 15,600
kgs., Rs. 1,68,107.

N-BUTANOL: From FRG: Mo-
ntari Industries Ltd., 20,000 kgs.,
Rs. 2,19,417; C. J. Shah & Co.,
13,260 kgs. Rs. 1,43,426; Sup-
arna Chemicals Pvt. Ltd., 12,480
kgs., Rs. 1,34,764.

BUTYLATED HYDROXY ANI-
SOLE: From Japan: Avon Servi-
ces P. Ltd., 1,000 kgs., Rs.
1,91,503.

CALCIUM SILICIDE POWDER
(SILACIUM): Zenith Ltd., 7
mts., Rs. 1,20,647.

CAPROLACTAM: From Bel-
gium: Jagatjit Cotton Text. Mil-
ls Ltd., 2,48,500 kgs., Rs. 60,-
97,776.

CARBOFURAN: From USA: Ral-
lis India Ltd., 9,000 kgs., Rs.
14,71,132.

✓ CARBON BLACK: From Thai-
land: Ceat Tyres (I) Ltd., 26
mts., Rs. 20,085.

CEDRYL METHYL ETHER:
From Netherlands: S. H. Kelkar
& Co. Ltd., 200 kgs., Rs. 1,88,-
839.

CHLORO CARBONIC ACID
METHYL ESTER: From FRG:
BASF India Ltd., 15,600 kgs., Rs.
2,97,731.

CHLOROPHENYLAMINE BA-
SE: From Japan: Transchem Pvt.
Ltd., 1,000 kgs., Rs. 4,79,761.

5-CHLOROTHEOPHYLLINE :
From FRG: May & Baker (India)
Ltd., 400 kgs., Rs. 1,63,612.

CHLORO TRIFLUORO METH-
ANE: From USA: Universal Com-
mercial Co., 163.3 kgs., Rs. 59,-
601.

CYCLOHEXANONE: From
China: Aroma Chemicals, 13,680
kgs., Rs. 1,86,491; India Pestic-
ides Pvt. Ltd., 13,680 kgs., Rs.
1,86,491.

DEHYDRO THIO PARA TOLU-
IDINE SULFONIC ACID: From
FRG: The Atul Products Ltd.,
3,000 kgs., Rs. 7,45,542.

DICHLOROAMINO DIPHENYL
ETHER: From France: Progres-
sive Dyestuffs, 1,000 kgs., Rs.
1,53,289.

2, 6 - DICHLOROBENZALDEHYDE: From FRG: Lotus Enterprises, 573 kgs., Rs. 1,93,424.

2, 4 - DICHLOROTOLUENE : From Japan: Seshadri Nihalani Menochem Ltd., 1,000 kgs., Rs. 1,01,233; From FRG: Jaycee Chemicals Pvt. Ltd., 960 kgs., Rs. 87,744.

1 - N - N - DIETHYLAMINE - 3 - PROPIONYLAMINE BENZOYL (DAPAB): From Switzerland: 3,091 kgs., Rs. 10,50,767.

2-6 DIETHYL ANILINE: From Switzerland: Sudarshan Chemical Industries, 14,820 kgs., Rs. 4,01,057.

DIETHYL CARBAMAZINE CITRATE USP: From Indonesia: G. Amphrey Laboratories, 1,950 kgs., Rs. 2,71,072.

DIETHYL GLYCOL: From Taiwan: C. J. Shah & Co., 6,075 kgs., Rs. 42,626.

DIETHYLENE GLYCOL: From Taiwan: C. J. Shah & Co., 5,850 kgs., Rs. 41,048, 6,075 kgs., Rs. 42,627.

DIHYDROMYRCENOL: From France: Oriental Aromatics, 50 kgs., Rs. 6,612; 100 kgs., Rs. 28,855.

DIMETHYL BENZYL CARBINOL: From Japan: The Tata Oil Mills Co. Ltd., 100 kgs., Rs. 18,436.

DIMETHYL CARBONATE: Cepham Laboratories Ltd., 5,000 kgs., Rs. 1,56,294.

DIMETHYL FORMAMIDE : From Japan: Indian Petrochemicals, 152 mts., Rs. 14,14,547.

DIMETHYL SULPHAMIDE: From USA: German Remedies Ltd., 11,000 lbs., Rs. 1,14,253.

1-3-DIMETHYL UREA: From FRG: Pefco Industries Ltd., 13,500 kgs., Rs. 2,25,495.

DMT: From Spain: Ester India Ltd., 500,000 kgs., Rs. 37,65,142.

DIPHENYLMETHANE DI ISOCYANATE: From FRG: United Matachem Pvt. Ltd., 10,000 kgs., Rs. 2,71,403.

DIPHENYLOXIDE: From FRG: Naarden (India) Ltd., 10,000 kgs.

EMULSIFIABLE POLYETHYLENE WAX: From Japan: Ajay Textiles, 2,000 kgs., Rs. 40,248; Fibro Chemical Industries, 5,000 kgs., Rs. 1,00,620.

ETHYLENE BIS-STEARYLAMIDE: From Netherlands: ABS Plastics Ltd., 13,000 kgs., Rs. 2,27,856.

ETHYLENE GLYCOL: From Japan: Amar Preet Enterprises Pvt. Ltd., 13,330 kgs., Rs. 1,29,880.

ETHYL GLYCOL ACETATE: From FRG: Dr. Beck & Co. Ltd., 10,150 kgs., Rs. 1,90,215.

2-ETHYL HEXANOL: From FRG: Herdillia Chemicals Ltd., 308.10 mts., Rs. 33,80,095; From UK: Kudalia Industries, 99,968 kgs., Rs. 12,78,440.

2-ETHYL HEXYL ACETATE: From UK: BASF India Ltd., 14,118 kgs., Rs. 3,23,967.

ETHYL METHYL BUTYRATE: From Switzerland: Pioma Industries, 25 kgs., Rs. 13,713.

FORMALDEHYDE: From USA: Acora Pao (India) Pvt. Ltd., 4 lbs., Rs. 11.

FORMIC ACID 85%: From FRG: K. P. & Co., 20,180 kgs., Rs. 1,54,428.

GAMMA FERRIC OXIDE: From FRG: The New Vinod Silk Mills Ltd., 17,500 kgs., Rs. 9,39,311.

GAMMA PICOLINE (MIN. ASSAY 98%): From Japan: Pfizer Ltd. 10,070 kgs., Rs. 3,72,612.

GLYOXAL 40%: From Japan: MK Marketing, 8 mts., Rs. '87,378; From FRG: Paresh Chemicals Corporation, 17,500 kgs., Rs. 1,89,982.

GUM ARABIC: From Iran: Salimpex Corporation, 1,980 kgs., Rs. 13,496.

GUM BENZOIN: From Singapore: Laxmi Traders, 5,004 kgs., Rs. 31,012.

GUM COPAL: From Indonesia: Vita Paints & Varnishes, 4,000 kgs., Rs. 32,240.

GUM ROSIN: From Indonesia: Bluebell Polymers Pvt. Ltd., 13,000 kgs., Rs. 1,20,355.

GUM ROSIN N GRADE: From China: Paulson Paint Cellulose Works, 35.1 mts., Rs. 2,27,856.

GUM ROSIN WW GRADE: From Indonesia: Viscous Oils & Allied Industries, 18,000 kgs., Rs. 1,22,727.

GUM TRAGACANTH PARDEN USP: From UK: Warner Hindustan Ltd., 200 kgs., Rs. 1,26,162.

✓ HELIOTROPIN: From Japan: Shah Incense Works, 270 kgs., Rs. 84,131.

HEXACHLOROPENTADIENE : From USA: Bharat Pulversising Mills Pvt. Ltd., 40,000 kgs., Rs. 9,03,634.

✓ HEXAMINE: From China: FDO Pvt. Ltd., 2,300 kgs., Rs. 22,396.

HYDROFLUORIC ACID: Unchem Industries, 2,900 kgs., Rs. 1,18,159.

HYDROFLUORIC ACID 50% MDS: Unchem Industries, 2,900 kgs., Rs. 1,09,313.

✓ HYDROGEN PEROXIDE 50% From Spain: Pluto Chemical Ltd., 12,825 kgs., Rs. 1,11,063. 8,550 kgs., Rs. 74,041; 12,825 kgs., Rs. 1,11,063; Sree Nanjur Deswar Weaving 33.6 mts., Rs. 2,72,648.

HYDROXY 3,5,8,11,14 PENTA
OXA HEXA DECANE: From FRG:
Colour-Chem Ltd., 500 kgs., Rs.
21,739.

HYDROXY - ETHYL
ETHYLENE - THIAMINE CHEMI-
CALS: From France: Agfa Geva-
ert India Ltd., 300 kgs., Rs.
43,970.

HYDROXY - OXA HEXADE-
CANOIC ACID OMEGA LACTO-
NE: From Netherlands: S. H. Kel-
kar & Co. Ltd., 300 kgs., Rs.
4,40,623.

IMINO DI-ACETIC ACID:
From Japan: Excel Industries
Ltd., 21,600 kgs., Rs. 20,37,632.
✓ IODINE CRUDE: From Chile:
Atul Products Ltd., 5,400 kgs.,
Rs. 12,61,971.

ISOBUTANOL: From FRG: Ja-
sud Chemicals & Mfg. Ltd.,
51,460 kgs., Rs. 4,40,958.

ISOBUTYL BENZENE: From
UK: Owell Drugs Pvt. Ltd., 6,840
kgs., Rs. 3,03,178.

ISOBUTYL BENZYL CARBI-
NOL: From Netherlands: S. H.
Kelkar & Co. Ltd., 25 kgs., Rs.
44,134.

ISO CAMPHYL CYCLOHEXA-
NOL: From Switzerland: Naard-
en India Ltd., 50 kgs., Rs. 13,-
568.

ISOCYANATE: From UK: IVP
Limited, 18,000 kgs., Rs. 4,78,-
266.

ISOCYCLODIMETHYL OCTA-
NOL: From FRG: The Tata Oil
Mills Co. Ltd., 360 kgs., Rs.
1,64,088.

ISOHEXANYL TETRAHYDRO-
BENZALDEHYDE: From France:
Oriental Aromatics, 50 kgs., Rs.
9,017.

ISOPHTHALIC ACID: From
Japan: Rallis India Ltd., 2,000
kgs., Rs. 25,447.

✓ LEATHER FINISHES: From
UK: Northern Tannery, 2,100
kgs., Rs. 88,083.

LILIAL: From Switzerland:
Naarden India Ltd., 50 kgs., Rs.
17,110; 50 kgs., Rs. 17,110.

LIQUID HELIUM: From USA:
Industrial Oxygen Co. Ltd., 34,-
377 ltrs., Rs. 17 66,461.

MALEIC ANHYDRIDE 99.5%
FLAKES: From FRG: Salvi Che-
mical Industries, 10 mts., Rs.
1,27,758.

MANGANESE CARBONATE:
Cosmo Ferrites Ltd., 10,000 kgs.,
Rs. 89,668.

METHYL CHLORO FORMATE:
From Hungary: Cadila Laborato-
ries P. Ltd., 5,000 kgs., Rs.
97,374.

METHYLENE BIS THIOCYAN-
ATE: From UK: Ion Exchange
(India) Ltd., 500 kgs., Rs. 74,-
276.

N - METHYLETHANOLAMINE:
From FRG: Wockhardt Ltd., 180
kgs., Rs. 7,773.

METHYL MERCAPTO M-CRE-
SOL: From FRG: Bayer (India)
Limited, 15,565 kgs., Rs. 21,56,-
001.

METHYL ETHYL KETONE:
From France: Garware Plastics &
Polyester Ltd., 27,200 kgs., Rs.
3,24,970; The New Vinod Silk
Mills P. Ltd., 13,600 kgs., Rs.
1,62,486.

METHYL ISOBUTYL KETONE:
From Taiwan: A. S. Corporation,
13,200 kgs., Rs. 1,47,386.

MOLYBDENUM TRIOXIDE:
From Japan: Finplex Cables Ltd.,
2,100 kgs., Rs. 2,04,486.

NATURAL ESSENTIAL OIL
CLOVE LEAF OILS: From Indone-
sia: Chemical Process Consul-
tants, 3,000 kgs., Rs. 94,240.

NATURAL ESSENTIAL OIL
ORANGE OIL: From USA: Naard-
en India Ltd., 16,200 kgs., Rs.
3,54,443.

NEOPENTYL GLYCOL: From
FRG: Universal Polymers, 2,000
kgs., Rs. 44,814.

OCTOIC ACID: From Sweden:
BVIJ Chemicals Ltd., 7,030 kgs.,
Rs. 1,02,225.

ORTHO CHLORO PARA NIT-
ROANILINE: From FRG: Indian
Dyestuff Ind. Ltd., 2,972 mts.,
Rs. 2,66,374; 2,978 mts., Rs.
2,66,912.

ORTHO CHLORO PHENOL:
From Japan: Sunbeam Monochem
P. Ltd., 2,000 kgs., Rs. 61,417.

PARA TERTIARY BUTYL PHE-
NOL: From Japan: Synthetics &
Polymers Ltd., 5,000 kgs., Rs.
84,391.

PATCHOULI OIL: From Indo-
nesia: The Tata Oil Mills Co.
Ltd., 800 kgs., Rs. 2,12,925.

PEPPERMINT OIL: From UK:
Flash Laboratories Pvt. Ltd.,
1,000 kgs., Rs. 2,61,280.

PHENYL ACETALDEHYDE DI-
METHYL ACETAL: From Swit-
zerland: Naarden India Ltd., 25
kgs., Rs. 8,507.

PHENYL PROPYL ALDEHYDE:
From Switzerland: S. H. Kelkar
& Co. Ltd., 400 kgs., Rs. 1,57,-
013.

PHTHALIC ANHYDRIDE: From
USSR: UK Paint Inds., 52 mts.,
Rs. 3,15,055.

PIVALOYL CHLORIDE: From
France: Cepham Laboratories
Ltd., 2,160 kgs., Rs. 1,41,272.

POLYOL: From Italy: Godrej
& Boyce Mfg. Co. P. Ltd., 58.5
mts., Rs. 12,97,805.

✓ POLYVINYL ALCOHOL: From
FRG: E. Merck (India) Ltd., 250
kgs., Rs. 48,888; From Japan:
C.D. Corporation, 2,000 kgs.,
Rs. 49,336; Fancy Dyeing &
Printing, 80 mts., Rs. 1,589; PD
Chemicals P. Ltd., 4,000 kgs.,
Rs. 88,286; Pidilite Industries P.
Ltd., 3,000 kgs., Rs. 66,215; Qu-
ality Carpet Traders, 31,160 kgs.,
Rs. 6,87,749; From Taiwan: The
Bombay Dyeing & Mfg. Co. Ltd.,
5 mts., Rs. 1,10,358.

POTASSIUM CHLORIDE WHI-
TE: From Canada: The Atul Pro-

ducts Ltd., 280 mts., Rs. 5,85,252.

PRECIPITATED SILICA: From Taiwan: Industrial Oil Traders, 6,060 kgs., Rs. 49,354.

PRIMULINE SULFONIC ACID: From FRG: The Atul Products Ltd., 883 kgs., Rs. 2,34,357.

N-PROPYLAMINE: From FRG: Suneeta Chemical, 2,100 kgs., Rs. 71,181.

SIZING CHEMICALS: From Japan: Reliance Inds. Ltd., 4,200 kgs., Rs. 76,341.

SODIUM ALGINATE SLH GRADE: From China: Fancy Dyeing and Printing, 0.175 mts., Rs. 5,560.

SODIUM CYANIDE GRANULAR 98/99%: PSH Chemicals, 2,000 kgs., Rs. 33,822.

SODIUM GLUCONATE: From Japan: Grauer & Weil Ltd., 2,000 kgs., Rs. 39,339.

SODIUM METHOXIDE: From FRG: German Remedies Ltd., 500 kgs., Rs. 25,277; Glazers Export India Ltd., 4,500 kgs., Rs. 2,25,496.

SOYA LECITHIN: From Brazil: Coates of India Ltd., 3 mts., Rs. 22,007.

STYRENE MONOMER: From Netherlands: Everest Paint Inds., 16 mts., Rs. 3,19,907.

SULPHUR: From Kuwait: Adarsh Chemicals & Fertilizers, 2,000 mts., Rs. 31,23,602; Century Textile & Ind. Ltd., 2,000 mts., Rs. 31,23,909; Rama Phosphates Ltd., 994 mts., Rs. 15,36,814; Arinder Agrochemicals Ltd., 2,000 mts., Rs. 30,95,741.

SULPHUR HEXAFLUORIDE GAS: From Japan: Crompton Greaves Ltd., 1,033 kgs., Rs. 85,389.

TERTIARY BUTYL ALCOHOL: From FRG: Phin-O-Chem Industries, 2,945 kgs., Rs. 77,986.

TERTIARY BUTYL CHLORIDE: From FRG: Unichem Laboratories Ltd., 165 kgs., Rs. 6,036.

THIONYL CHLORIDE: From FRG: Cadila Laboratories P. Ltd., 4,000 kgs., Rs. 50,414; 200 kgs. Rs. 52,935; From Switzerland: Excel Industries Ltd., 1,15,500 kgs., Rs. 11,09,679.

THIOUREA: From Japan: Bhadresh Chemical Industries, 4,000 kgs., Rs. 92,441; J. M. Chemicals Industries, 5,000 kgs., Rs. 1,15,551; Verb Chemicals Industries, 5,000 kgs., Rs. 1,15,551; Verb Chemicals Industries, 5,000 kgs., Rs. 1,15,551.

TITANIUM DIOXIDE RUTILE: From FRG: Asian Paints India Ltd., 20,000 kgs., Rs. 5,45,296; From Japan: Bhavanidas Gangadas & Co., 2,500 kgs., Rs. 74,654; Garware Paints Ltd., 20,000 kgs., Rs. 5,08,944; M/s. BASF India Ltd., 6,000 kgs., Rs. 1,71,769.

TRICHLORO / TRIFLUORO ETHANE: From Japan: Hyderabad Allwyn Ltd., 500 kgs., Rs. 23,135; From Japan: Mafatlal Industries Ltd., 3,000 kgs., Rs. 54,919.

TRIETHYL PHOSPHATE: From FRG: Indian Dyestuff Ind. Ltd., 3 mts., Rs. 1,01,269.

3,4,5-TRIMETHOXY BENZALDEHYDE: From China: Suchem Laboratories, 950 kgs., Rs. 2,71,350.

3,4,5-TRIMETHOXY BENZALDEHYDE MIN. 99%: From Japan: Zora Pharma Pvt. Ltd., 2,010 kgs., Rs. 6,06,746.

2,3,6-TRIMETHYL PHENOL: From FRG: E. Merck (India) Ltd., 2,470 kgs., Rs. 2,29,431.

TRIPHENYL PHOSPHATE: From Japan: Ranbaxy Laboratories Ltd., 2,000 kgs., Rs. 2,91,261.

VANILLIN: From France: Hindustan Lever Ltd., 1,300 kgs., Rs. 2,21,949.

M-XYLIDINE: From FRG: Asiatic Industries, 1,000 kgs., Rs. 1,30,367.

YLANG PETAL OIL: From FRG: The Tata Oil Mills Co. Ltd., 150 kgs., Rs. 66,818.

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SULPHUR BLUE: From China: J.P. Shah & Co., 1500 kgs., Rs. 53,556.

SULPHUR GREEN BLUE CV: From China: J.P. Shah & Bros., 500 kgs., Rs. 27,265.

SULPHUR YELLOW GR: From China: J.P. Shah & Bros., 3000 kgs., Rs. 81,794.

NIGROSINE BASE EX: From Japan: Joshi Formulabs Pvt. Ltd., 500 kgs., Rs. 57,775.

TEXTILE AUXILIARY: From UK: S.F. Chem Kindu P. Ltd., 510 kgs., Rs. 1,35,508.

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